BANK HOLDING COMPANY GOVERNANCE, OPACITY AND RISK

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ABSTRACT

As financial intermediaries, banks are "special" because they play an important role in transferring funds from surplus spending units to deficit spending units and serve as a channel of monetary policy. Therefore, the safety and soundness of banks is essential to the financial stability and economic development. This study investigates how bank governance mechanisms, namely, executive compensation and board of directors, affect bank safety. Given the unique nature that bank assets are opaque, bank governance is expected to be different from corporate governance of industrial firms. This study also investigates how the opaqueness nature of bank assets affects the compensation design of bank executives.

Chapter 1 investigates the association between asset opacity and CEO pay-performance sensitivity of bank holding companies (BHCs). Contrary to the monitoring cost hypothesis according to which when information asymmetry is high firms rely more heavily on equity-based compensation, I find that when the share of opaque assets in total assets increases, pay-performance sensitivity in BHCs declines. This finding supports the view that when the share of opaque assets increases, managers can pursue risky projects to a greater extent in the interests of shareholders but at the expenses of bondholders, and, hence, the optimal compensation structure in BHCs with larger share of opaque assets has a lower pay-performance sensitivity to restrain managerial risk-taking incentives, reducing the conflicts of interests between shareholders and bondholders. The negative effect of asset opacity on pay-performance sensitivity is robust after accounting for the endogeneity of asset opacity and using various compensation measures. In addition, I find

that higher pay-performance sensitivity generally leads to a greater share of opaque assets in total assets. The results of this study suggest that asset opacity is an important determinant of compensation structure in the banking industry. BHCs should use caution when using stocks and options to promote prudent risk taking under bank asset opacity conditions because opaque bank assets make risk-shifting behaviors induced by equity-based compensation difficult to monitor, threatening the bank stability. Regulators should also account for this opacity effect.

Chapter 2 investigates the relationship between insolvency risk and executive compensation for BHCs over the 1992-2008 period. I employ CEO compensation sensitivity to risk (vega) and pay-share inequality between the CEO and other executives as measures of compensation and employ a simultaneous equation model to account for the endogeneity problem between vega and risk. Five main results are obtained. First, CEO compensations in BHCs have risen in response to deregulation to resemble those of the industrial firms. Second, higher vegas lead to greater bank instability. Third, the association between bank stability and managerial compensation is bi-directional; higher vegas induce greater risk and vice versa. Fourth, BHCs in the next to the largest-size group increase CEO vegas the most and have the strongest potential to create instability in the financial industry, such as the one witnessed in 2007-2009. Fifth, increased pay-share inequality has effects opposite to those of the increase in vega; greater pay-share inequality is associated with greater bank stability. Implications of executive compensation effects on instability for depositors, deposit insurers and regulators are drawn.

Chapter 3 investigates the association between the structure of board of directors and risk taking of bank holding companies. I use the number of directors on the risk committee and the frequency of its meetings to measure the strength of risk management exercised by bank boards. Several interesting findings are obtained. First, banks with stronger risk committees, namely risk committees with a greater number of directors and more frequent meetings, are associated with more diversified loan portfolios, greater amounts of safer loans, less mortgage-backed securities, and lower market risk. These results continue to hold even after controlling for the possible endogeneity problem using the dynamic panel GMM estimator. Overall, these results suggest that stronger risk management by bank boards has a positive and significant impact on banks’ safety and soundness. Second, the percentage of banks having a risk committee has been increasing steadily since 1999, suggesting bank boards have gradually taken a greater role in risk management and their fiduciary duties have expanded beyond shareholders to include depositors. However, less than half of bank boards have a risk committee before 2007, suggesting weak risk management at the top level and the possibility that bank boards may have failed to control the excessive risk-taking in the banking industry leading to the recent financial crisis. Finally, the percentage of banks with a risk committee is still less than 60% after the crisis, suggesting that depositors and bank supervisors could enhance the stability of banks by further improving the effectiveness of internal risk control at bank boards.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

ASSET OPACITY AND CEO COMPENSATION OF BANK HOLDING COMPANIES

1.1 Introduction

Managerial compensation is an important corporate governance mechanism used to align the interests of the top management with those of the owners. The relationship between managerial compensation and firm performance, measured as pay-performance sensitivity, has recently been playing a greater role in mitigating the agency problems among managers and shareholders as options and stockholdings comprise an increasing component of managerial compensation (Hall and Liebman (1998)).

Pay-performance sensitivity in banks has received greater attention recently because of increased competition brought about as a result of financial liberalization legislature such as Interstate Branching Act (1994), and the Gramm-Leach-Bliley Act (GLBA 1999) allowing product diversification across commercial banking, investment banking and insurance activities, as well as globalization, and advancement in technology. Hubbard and Palia (1995) and Crawford et al. (1995) document a significant increase in the CEO pay-performance sensitivity after the deregulation of interstate banking. Fields and Fraser (1999) also find that CEO pay-performance sensitivity of commercial banks increases as they shift from traditional banking to investment banking.

However, the opaque nature of banks has received little attention in the managerial compensation literature. As delegated monitors, bank insiders possess valuable private information about loan borrowers while the quality of these loans and monitoring efforts are informationally opaque to outsiders (Diamond (1984)). Morgan (2002) presents evidence that bond raters have a greater level of disagreement when banks' loans and trading assets constitute a greater share of their total assets. As opaque assets make direct monitoring of bank managers more difficult and costly, shareholders find it imperative to rely more on equity-based compensation because stock performance provides incremental information about managerial actions (Holmstrom (1979)). However, higher equity-based compensation contracts may induce managers to act opportunistically and take excessive risks as compensation contracts cannot completely specify all aspects of managerial behavior (Baker (1992)). When banks have a relatively larger share of opaque assets, it is more difficult to detect managerial opportunistic behaviors. As managers are awarded with more equity-based compensation such as stocks and stock options, they are more likely to act in the interests of shareholders and to invest in risky projects. When those risky projects pay off, shareholders capture most of the gains. However, the downside risk of those risky projects is borne by the depositors and deposit insurer as shareholders' loss is limited to the equity. As the share of opaque assets increases, the risk-shifting problems induced by equity-based compensation are more difficult to detect. Therefore, banks with more opaque assets could use less equity-based compensation to mitigate the risk shifting from the shareholders to the depositors and deposit insurer. This is particularly important as the high financial leverage in the banking industry creates greater incentives for shareholders to take on more risks. Crawford et al. (1995) find that the increase in the pay-performance sensitivity for CEOs in banks that have low capital ratios is even larger for CEOs in banks that have high capital ratios, suggesting severe moral hazard problem between deposit insurers and shareholders in low-capitalized banks after deregulation. Given the opaque nature of bank assets and high leverage in banks, bank deposit insurers and regulators should be more cautious about managerial compensation based on equity because of the risk-taking incentive. Overall, we expect asset opacity to be an important determinant of pay-performance sensitivity in the banking industry.

This paper examines how pay-performance sensitivity depends on the share of opaque assets in total assets of BHCs[1]. We employ the percentages of loans and trading assets to proxy the level of opacity of bank assets. Because managerial compensation affects the firm's investment policy, we also investigate whether the incentive-based pay has any effect on level of opaque assets in order to investigate the possible endogeneity between compensation and BHCs' assets choices, and to address the simultaneity issue by using a system model. Our simultaneous regression results provide evidence that managerial compensation provides incentives for managers to increase the percentage of opaque assets. We find that in the aggregate sample pay-performance sensitivity decreases when the percentage of opaque assets in BHCs' total assets increases. Specifically, an increase in the share of loans and trading assets in total assets has a significant and negative effect on pay-performance sensitivity.

Our findings have several implications. First, as opaque bank assets invite excessive risk taking, BHCs with larger share of opaque assets trade off the shareholder-manager incentive alignment to mitigate the conflicts of interest between shareholders

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[1] Under U.S. law, any firm that controls a bank is supervised as a ''bank holding company''. Bank ''control'' is defined as holding more than 25% of a bank's equity shares or the ability to elect at least two directors.

and bondholders. A relatively lower pay sensitivity to stock performance can serve as a pre-commitment device to discourage executives from taking excessive risks. Depositors and deposit insurers should be more cautious with BHCs with larger share of opaque assets and greater pay-performance sensitivity because those BHCs may be exposed to greater risk. Secondly, since the opaque nature of bank assets discourages the use of pay-performance sensitivity for aligning interests of managers and shareholders, BHCs should depend more on other corporate governance mechanisms, such as board of directors, to further their performance.

The paper is organized as follows. Section 2 reviews the related literature and develops the hypotheses. Section 3 describes the sample data and variable construction. Section 4 presents the empirical results and Section 5 concludes.

1.2 Literature Review and Hypothesis Development

Managerial compensation is a corporate governance mechanism that is used to alleviate the agency problem identified by Jensen and Meckling (1976) because of the separation of ownership and control in modern corporations (Berle and Means (1932)). Specially, because managers have better skills and superior information in making investments, shareholders prefer to tie their objective of maximizing shareholder value to managerial compensation. Within the management team, CEOs are the most important agent and their compensation is more sensitive to the overall firm performance than other executives (Aggarwal and Samwick (2003)). Barro and Barro (1990) find that changes in bank CEO compensation have a direct (positive) relationship with the firm’s accounting and stock performance. Jensen and Murphy (1990) document that the CEO wealth change is $3.25 for every $1,000 change in shareholder value. Hall and Liebman (1998) show that pay-performance sensitivity of CEO compensation has risen dramatically since 1990s because of the increase in option awards and managerial stockholdings over the same period.

CEO compensation in the banking industry focuses on regulation and high leverage. Because bank managers have limited investment opportunity sets, in comparison with the firms in unregulated industries, due to the constraints imposed by regulation, bank executive compensation is expected to be less responsive to firm performance. John and John (1993) argue that managerial compensation in a levered firm should serves as a pre-commitment device to minimize the conflicts of interest between stockholders and bondholders because high equity-based compensation may induce managers to shift downside risk from stockholders to bondholders (Jensen and Meckling (1976)). Therefore, bank CEO compensation is expected to have lower pay-performance sensitivity because of the high leverage in banks. Consistent with those arguments, Houston and James (1995) find bank CEOs receive a smaller percentage of their total compensation in the form of options and stocks than do CEOs in other industries. John and Qian (2003) also present evidence that pay sensitivity to stock return in the banking industry is significantly lower than it is in the manufacturing industry.

However, the opaque nature of bank assets receives little attention in the managerial compensation literature. We argue that there are two opposing forces driving the choice of the pay-performance sensitivity when the assets are opaque. First, a highly sensitive pay-for-performance scheme allows managers who can better manage opaque assets to be better compensated. In banks, loans and trading assets are the primary sources of bank opacity (Flannery, Kwan and Nimalendran (2004); Morgan (2002)). As bank's primary assets, loans are customized and privately negotiated, resulting in lack of transparency. The trading assets of banks are transparent but trading positions are easy to change and difficult to track. Therefore, the quality and value of those assets and bank's monitoring efforts are informationally opaque to bank outsiders (Morgan (2002)). Loan making and asset trading requires a substantial amount of managerial discretion and skills while shareholders and bondholders have little knowledge or information in this regard. Therefore, banks require managerial talent and effort commensurate with the share of opaque assets. Since a compensation contract including a greater component from managerial stockholding and stock options allows high quality managers to share more of the gains, a highly sensitive pay-for-performance compensation can attract talented managers and encourage greater managerial efforts (Jensen and Murphy (1990)). Therefore, it is expected that a greater share of opaque assets is associated with higher pay-performance sensitivity. In addition, Holmstrom (1979) emphasizes the information contained in the stock-based performance. He argues that managerial compensation should be based on stock performance because stock performance provides incremental information about managerial actions. As monitoring opaque bank assets is prohibitively costly, it is optimal to set higher pay-performance sensitivity when opaque assets have a greater share in total assets. The above argument gives rise to the following hypothesis:

H_{1a}: Pay-performance sensitivity of CEO compensation increases with asset opacity in BHCs.

On the other hand, when assets are opaque, higher equity-based compensation contracts may not be desirable because these contracts cannot completely specify all relevant aspects of managerial behavior and the excessive incentive may induce managers to act opportunistically (Baker (1992)). John and John (1993) contend that the optimal top-management compensation structure should reflect all contracting relationships among shareholders, managers and bondholders for which the firm serves as a nexus. More specifically, managerial compensation should be designed not only to align the interests of managers and shareholders but also to mitigate the conflicts of interest between shareholders and bondholders. When managers are rewarded with more equity-based compensation, they are more likely to make high-risk investments that increase shareholder values at the expenses of bondholders (Jensen and Meckling (1976)). Given the high leverage in banks, the agency problem between shareholders and bondholders become more severe because shareholders have greater incentive to take excessive risk. Saunders et al. (1990) document that the bank's capital market risk increases significantly with the managerial stock ownership and that the risk taking behavior is more pronounced during the 1979-1982 period of the activity and interest rate deregulation. Since it is difficult to monitor and detect manager's risk-taking behavior when assets are opaque, high equity-based compensation contracts may not be optimal for BHCs under these circumstances. The above argument gives rise to the following hypothesis:

H_{1b}: Pay-performance sensitivity of CEO compensation decreases with asset opacity in BHCs.

1.3 Data Description

1.3.1 Sample Collection

The sample period runs from 1992 to 2008. To be included in the sample, we require BHCs to have executive compensation data on Standard & Poor's Execucomp and to file the Federal Reserve's Consolidated Financial Statements for Bank Holding Companies (FR Y9C report). We obtain BHC stock price and return information from CRSP. We use Execucomp to construct the measures of CEO compensation and firm performance. Execucomp database provides information on all aspects of executive compensation and covers the S&P 1500 plus companies. This database also contains those companies that were removed from the index but are still trading. Data collection on the S&P 1500 began in 1994. Although data go back to 1992, they do not cover the entire S&P 1500 firms during the 92-94 period. Executive compensation data are collected from each company's annual proxy. Execucomp collects compensation data up to 9 executives for a given year, though most companies report only 5 executives. ExecuComp identifies executives as CEOs and documents the dates at which the executive became CEO and he/she left the CEO office. We classify the executive who appears to be the CEO based on these dates, even if Execucomp fails to identify him/her as the CEO.

Y9C report collects financial data from a BHC on a consolidated basis in the form of balance sheet, income statement, and detailed supporting schedules, including a schedule of off balance-sheet items. Y9C report provides quarterly data on variables such as total assets, loans, trading assets and capital. To make a consistent data series with CEO compensation data, we retain the fourth quarter figures from the Y9C reports as the basis for the annual figures.

The sample is constructed as follows. First, we extract all BHCs from Y9C report database and obtain 733 BHCs. Second, we extract all financial firms from Execucomp from 1992 through 2008 based on SIC codes (6000-6999) and obtain 456 financial firms including BHCs. Third, we manually match the 733 BHCs from Y9C report database with the 456 financial firms from Execucomp by company name and headquarter state and obtain 132 BHCs. The final sample contains 216 CEOs, and 1062 CEO-Year observations.

1.3.2 Variable Construction

We use the variable delta as our primary pay-performance sensitivity measure. This variable is defined as the dollar value change of the executive's wealth for a 1% change in stock price. The delta calculation follows Guay (1999) and Core and Guay (2002) approach which uses the Black and Scholes (1973) option valuation model as modified by Merton (1973) to account for dividends. The use of delta as pay-performance sensitivity is consistent with numerous recent papers such as Yermack (1995), Hall and Liebman(1998), Aggarwal and Samwick (1999), Palia (2001), Coles et al. (2006). To remove the effect of inflation, all dollar-valued data are converted into constant year 1992 dollars by the consumer price index obtained from the Bureau of Labor Statistics.

We use the percentages of loans in total assets and the percentage of trading assets in total assets as the measures of asset opacity because prior researchers find loans and trading assets to be the two primary sources of opacity in BHCs. As "delegated monitors", banks acquire proprietary information about their loans (Diamond (1984); Sharpe (1990)). Therefore, the quality of loans is opaque to outside investors. Another source of asset opacity for outside investors is banks' trading assets. Although trading assets are transparent and liquid, the trading positions can change rapidly which make trading assets difficult to track (Myers and Rajan (1998)). Consistent with the above argument, Morgan (2002) documents that increased loans and trading assets lead to a greater disagreement between bond raters. Flannery et al. (2004) find that loans and trading assets increase the stocks' effective spread as well as the dispersion of analyst forecast errors.

Off-balance sheet activities (OBSAs) of BHCs have grown rapidly in the recent years due to increases in financial innovations, market competition and risk. OBSAs include a variety of items such as loan commitments, certain letters of credit, and interest rate and foreign exchange rate contracts. Such activities normally generate fees and produce deferred or contingent liabilities or assets. Therefore, under Generally Accepted Accounting Principles (GAAP), these activities do not appear on the institution's balance sheet until or unless they become actual assets or liabilities. One view of OBSAs is that the hidden nature of these activities makes them difficult to monitor (Berger, Bonime, Covitz and Hancock (2000)). Since most BHCs have interest contracts for trading and non-trading purposes, we use the ratios of the nominal values of those interest contracts to total assets to proxy the opacity of OBSAs of BHCs. This choice increases the number of usable observations substantially.

The control variables used in this study as determinants of the pay-performance sensitivity are all based on the existing literature. First, we use the logarithm of total assets to proxy for BHC size. Jensen and Murphy (1990) argue that 'a highly sensitive pay-for-performance system will cause high-quality people to self-select into a company'. Given that managerial labor market is competitive, we expect talented managers to prefer to have their compensations tied more strongly to firm performance. Larger firms are complex and require more managerial efforts and talents (Rosen (1992)). Therefore, we expect that the level of pay-performance sensitivity will increase with firm size. Second, we use CEO tenure and CEO cash compensation to proxy for the CEO's career concerns and the level of risk aversion. Gibbons and Murphy (1992) argue that CEOs with longer tenures have less career concerns and are more likely to be entrenched. To align the interests of CEOs with those of the shareholders, the optimal compensation contract should have a higher pay-performance sensitivity for CEOs with longer tenures and more cash compensation because these CEOs are more risk averse and/or more entrenched. Third, we use capital ratio, defined as the ratio of equity capital to total assets, to proxy for the leverage. John and John (1993) argue that the optimal managerial compensation should not only align the interests of managers and shareholder but also mitigate the conflicts of interests between shareholders and bondholders because the firm serves as a nexus of managers, shareholders and bondholders. As increased leverage invites shareholders to take risks at the expenses of bondholders, managerial compensation with a lower pay-performance sensitivity can restrain risk-shifting incentives of managers on behalf of shareholders. Therefore, we expect a negative (positive) relationship between pay-performance sensitivity and leverage (capital ratio).

Lastly, we use number of analysts and analyst forecast errors to proxy for the supply of information about the firm. It is expected that the more analysts follow the firm, the less asymmetric information between the public and the firm. Brennan and Subrahmanyam (1995) argue that greater analyst coverage tends to reduce the adverse selection costs. Krishnaswami and Subramaniam (1999) suggest analysts' earnings forecasts errors provide a proxy for information asymmetry. We obtain analyst and analyst forecast information from I/B/E/S. Following Flannery et al. (2004), we measure analysts' forecast errors as the ratio of the absolute difference between actual annual earnings and the mean forecast one-month before the earnings announcement. The forecast errors are standardized by the stock price at the fiscal year end.

1.3.3 Sample Descriptive Statistics

Table 1 reports the descriptive statistics for the total assets and the assets composition of BHCs. The BHCs in our sample are the largest U.S. banking firms with the average asset size of 72.25 billion. The largest category of assets is loans, which represents 62% of total assets on average. The second largest category of bank assets is securities, which represents 21% of total BHC assets on average. The trading assets[2] represent a relatively small percentage of total assets on average, but they have a relatively wide range. Other BHC assets are cash, Federal funds and reverse repurchase agreements, premises and intangibles. BHCs have a very high leverage with the average capital ratio of 7.88%.

[2] Bank holding companies that (a) regularly underwrite or deal in securities, …, other assets for resale, (b) acquire or take positions in such items principally for the purpose of selling in the near term or otherwise with the intent to resell in order to profit from short-term price movements. (Instructions for Preparation of Consolidated Financial Statements for Bank Holding Companies)

Table 1. Sample Statistics of Bank Holding Companies Assets

	N	Mean	Standard Deviation	Min	25th percentile	50th percentile	75th percentile	Max
Cash (%)	1062	5.62	4.87	0.63	2.94	4.26	6.35	37.24
Securities (%)	955	20.91	9.53	0.52	14.35	20.26	25.38	61.10
Federal funds and repurchases (%)	395	2.18	3.79	0.00	0.02	0.48	2.40	19.49
Total loans (%)	1062	62.26	13.79	4.88	57.23	65.84	70.72	92.46
Trading assets (%)	1062	1.83	5.24	0.00	0.00	0.10	1.02	52.43
Premises (%)	1062	5.62	0.77	0.17	1.02	1.34	1.72	7.41
Intangible assets (%)	1062	20.91	1.90	0.00	0.39	0.96	2.29	16.29
Total Assets (in Billions)	1062	72.25	197.36	0.39	6.38	17.31	50.59	2,187.63
Interest contract for trading/Total assets	885	1.04	4.25	0.00	0.00	0.00	0.12	43.34
Interest contract for non-trading/Total assets	885	0.09	0.25	0.00	0.00	0.02	0.09	4.01
Capital Ratio (%)	816	7.88	1.79	3.47	6.78	7.59	8.53	22.80

Table 2 reports the descriptive statistics for CEO compensation of BHCs. Consistent with prior literature (e.g. Guay (1999)), we winsorize delta, and cash compensation at the 1st and 99th percentiles to reduce the possible effect of outliers on our results. The average value of cash compensation (salary plus bonus) of CEOs is around $1.44 million with the median of $0.89 million. The total annual compensation which includes the values of restricted stocks granted, options granted, and long-term incentive payouts is about $4.31 million with the median of $1.99 million. The total annual compensation is about 3 times as large as cash compensation. The standard deviation of total compensation is 5 times bigger than that of salary plus bonus. This suggests that restricted stock grants and option grants are an important and volatile component of CEO annual compensation. The wealth change of CEOs including direct stockholding and options of CEOs is even higher. The mean (median) value of a CEO's firm-specific wealth change is $14 million and 3.5 million. Mean (median) delta is $413,430 ($190,590), that is, for every 1% stock price increase, the CEO wealth increases by $413,430 ($190,590) on average.

Table 2. Sample Statistics of CEO Compensation

	N	Mean	Standard Deviation	Min	25th percentile	50th percentile	75th percentile	Max
CEO Tenure (years)	887	7.21	5.89	0.00	2.58	5.58	10.75	27.92
Salary ($Thous)	1067	578.31	250.39	29.14	402.19	568.77	718.38	2,339.63
Bonus ($Thous)	1067	865.17	1617.35	0.00	119.25	357.04	922.50	22,112.50
Cash Compensation ($Thous)	1067	1443.48	1736.84	79.68	581.44	890.64	1,574.85	22,875.00
Total Annual Compensation ($Thous)	1063	4314.37	9128.09	178.49	1,081.74	1,989.87	4,488.46	187,420.00
Change in firm-specific wealth ($Thous)	1067	832.14	79640.90	-410,217.70	-1,000.03	2,217.82	8,970.15	511,372.10
Delta($Thous)	1067	413.43	636.69	0.15	82.94	190.59	489.72	7,328.14

Table 3 reports the pair wise correlation for the key variables in the sample. We find a negative relation between the delta and the percentage of loans in total assets. However, the delta exhibits a positive relation with the percentage of trading assets in total assets. Because the size of BHCs is an important determinant of pay-performance sensitivity and correlated with many other variables, we compare delta of CEOs in BHCs with different levels of asset opacity after controlling firm size. Table 4, Panel A, reports the delta difference between CEOs in BHCs with loans in total assets above the median and those with loans in total assets below the median. CEOs in BHCs with loans in total assets above the median have a significantly smaller delta than those with loans in total assets below the median. Table 4, Panel B, reports the delta difference between CEOs in BHCs with trading assets in total assets above the median and those with trading assets in total assets below the median. CEOs in BHCs with trading assets in total assets above the median have a smaller delta than those with trading assets in total assets below the median, but the difference is insignificant. Because firm size, leverage and CEO attributes likely affect asset opacity and pay-performance sensitivity, we examine our main hypotheses using a multiple regression analysis.

Table 3. Correlations between Bank Assets and CEO Compensation

	Log(Total Assets)	Loans /Total Assets	Trading assets/ Total Assets	Cash compensation	Annual compensation	Delta	CEO tenure	Capital ratio	Large time deposits	Fed Funds Rate	Non-interest income	Lagged non-interest income	Trading revenue
Log(Total Assets)	1.00												
Loans/Total Assets	-0.19	1.00											
	(0.00)												
Trading assets/Total Assets	0.51	-0.46	1.00										
	(0.00)	(0.00)											
Cash compensation	0.60	-0.28	0.59	1.00									
	(0.00)	(0.00)	(0.00)										
Annual compensation	0.63	-0.27	0.45	0.68	1.00								
	(0.00)	(0.00)	(0.00)	(0.00)									
Delta	0.42	-0.15	0.24	0.50	0.52	1.00							
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)								
CEO tenure	-0.07	0.13	-0.10	-0.05	-0.07	0.03	1.00						
	(0.04)	(0.00)	(0.00)	(0.13)	(0.05)	(0.43)							
Capital ratio	-0.40	0.28	-0.34	-0.25	-0.17	-0.12	-0.05	1.00					
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.20)						
Large time deposits	-0.34	0.10	-0.16	-0.18	-0.12	-0.01	0.00	0.25	1.00				
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.75)	(0.88)	0.00					
Fed Funds Rate	-0.04	0.07	0.00	-0.10	-0.04	-0.05	0.09	-0.07	-0.03	1.00			
	(0.20)	(0.03)	(0.92)	(0.00)	(0.21)	(0.12)	(0.01)	0.04	(0.41)				
Non-interest income	0.74	-0.13	0.54	0.50	0.51	0.40	-0.04	-0.38	-0.29	-0.09	1.00		
	(0.00)	(-0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.47)	(0.00)	(0.00)	(-0.07)			
Lagged non-interest income	0.72	-0.13	0.53	0.49	0.51	0.38	-0.05	-0.37	-0.29	-0.09	0.99	1.00	
	(0.00)	(-0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.31)	(0.00)	(0.00)	(-0.06)	(0.00)		
Trading revenue	0.35	-0.25	0.53	0.55	0.44	0.39	-0.07	-0.15	-0.10	-0.05	0.27	0.27	1.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.05)	0.00	(0.00)	(0.17)	(0.00)	(0.00)	

Note: *P*-values are reported in parentheses below each correlation estimate.

Table 4. Comparison of CEO Pay-performance Sensitivity in BHCs with Different Level of Opaque Assets

Panel A. Compare delta in BHCs with the total loans in total assets above and below the median

BHCs by level of total loan	Delta				Difference of Delta	
	Obs	Mean	Std. Error	Std. Dev	95% Confidence Interval	
High	528	-48.16	15.79	362.74	-79.17	-17.15
Low	523	48.62	19.11	437.00	11.08	86.16
Difference		-96.79	24.76		-145.38	-48.19

Diff = mean(High) - mean(Low)				
T	-3.91		Degree of freedom	1049
Ho: diff = 0				
Ha: diff < 0	Ha: diff !=0	Ha: diff > 0		
Pr(T < t) =0.00	Pr(T > t) =0.00	Pr(T > t) =1.00		

Panel B. Compare delta in BHCs with the trading assets in total assets above and below the median

BHCs by level of trading assets	Delta				Difference of Delta	
	Obs	Mean	Std. Error	Std. Dev	95% Confidence Interval	
High	526	-2.83	19.49	446.98	-41.12	35.45
Low	525	2.84	15.56	356.49	-27.73	33.40
Difference		-5.67	24.94		-54.62	43.27

Diff = mean(High) - mean(Low)				
T	-0.23		Degree of freedom	1049
Ho: diff = 0				
Ha: diff < 0	Ha: diff !=0	Ha: diff > 0		
Pr(T < t) =0.41	Pr(T > t) =0.82	Pr(T > t) =0.59		

1.4 Multiple Regression Analysis

1.4.1 Pay-performance Sensitivity and Opaque Assets

In this section, we examine whether asset opacity matters in setting of the CEO compensation structure. Following Core and Guay (1999), our empirical model takes the following form:

$$\begin{aligned} Delta_i = {} & \beta_0 + \beta_1 \times TotalAssets_j + \beta_2 \times Loans_j + \beta_3 \times TradingAssets_j + \beta_4 \times ICNT_j + \beta_4 \times ICNNT_j \\ & + \beta_5 \times CashCompensation_i + \beta_6 \times CEOTenure_i + \beta_7 \times NumberofAnalyts_j \\ & + \beta_8 \times ForecastError_j + \beta_9 \times CapitalRatio_j + \varepsilon_i \end{aligned} \quad (1)$$

In this model, $Delta_i$ denotes the executive's wealth change for a 1% change in stock price for CEO *i* of BHC *j*. *TotalAssets* is the natural logarithm of total assets in the BHC *j*. *Loan* and *TradingAssets* are the percentages of loans and trading assets in total assets. *ICNT* and *ICNNT* are ratios of interest rate contracts for trading and non-trading purpose in nominal amount to total assets, respectively. *CashCompensation* is the salary and bonus for CEO *i* in year *t*. *CEOTenure* is the number of years the executive has served as CEO. *NumberAnalyst* is the total number of analysts following the BHC. *ForecastError* is the ratio of the absolute difference between actual annual earnings per share and the mean forecast, divided by the stock price at the fiscal year end. *CapitalRatio* is the capital to assets ratio of BHC *j*.

Table 5 presents the parameter estimates of Equation (1). The coefficient of the logarithm of total assets is positive and statistically significant at the 1% level in all specifications, suggesting that larger BHCs have compensation contracts more sensitive to firm performance. Given the greater difficulty of monitoring the managers in larger firms, the managers need to be incentivized to work harder. Greater pay-performance sensitivity is also a mechanism to attract more talented managers. The coefficient of CEO tenure is also positive and statistically significant at the 1% level in all models, suggesting that BHCs increases pay-performance sensitivity as CEOs assume office longer and have more cash compensation because those CEOs are more risk averse and more likely to give up positive NPV projects.

Table 5. Regressions Relating Opaque Assets to CEO Pay-performance Sensitivity

	Delta	Delta	Delta	Delta
Intercept	-1.95 ***	-1.47 ***	-2.31 ***	-2.23 ***
	(-8.15)	(-5.65)	(-8.05)	(-5.80)
Log(Total Assets)	0.160 ***	0.109 ***	0.138 ***	0.139 ***
	(11.41)	(7.05)	(8.93)	(6.41)
% of Loans	-4.93 ***	-3.27 ***	-4.08 ***	-6.25 ***
	(-4.34)	(-2.94)	(-3.57)	(-4.31)
% of Trading Assets	-27.94 ***	-31.63 ***	-35.19 ***	-38.79 ***
	(-4.76)	(-4.18)	(-5.43)	(-5.35)
ICNT/Total Assets	0.32 ***	0.24 ***	0.25 ***	0.28 ***
	(4.66)	(3.56)	(4.22)	(3.92)
ICNNT/Total Assets	2.69 **	3.07 **	2.88 **	5.47 ***
	(2.19)	(2.44)	(2.31)	(4.55)
CEO tenure		9.34 ***	10.98 ***	12.83 ***
		(4.14)	(4.51)	(4.05)
Cash Compensation		0.12 ***	0.11 ***	0.10 ***
		(6.67)	(7.06)	(3.69)
Capital Ratio			49.26 ***	53.85 ***
			(4.40)	(4.07)
Number of Analysts				-1.27
				(-0.16)
Analyst Forecast Error				-61.64
				(-0.78)
R-square	0.35	0.49	0.53	0.56
# of Observations	867	713	657	410

Note: The t-statistics are based on standard errors within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Consistent with the argument of John and John (1993) that optimal managerial compensation could mitigate the agency problem between shareholders and bondholders by taking a firm's capital structure into account, we find that managerial pay-performance sensitivity increases as capital ratio increases. The coefficient of the capital ratio is significantly positive at the 1% level indicating that greater capital (lower leverage) translates into greater pay-performance sensitivity with the purpose of reducing conflicts between shareholders and bondholders. The result is consistent with the findings of John and Qian (2003) that pay-performance sensitivity decreases with increased debt ratio (lower capital) in the banking industry.

The number of analysts, and analyst forecast errors, are included as regressors in the model as proxies for information asymmetry between insiders and outsiders. The coefficients of these variables are both insignificant. The reason is that the analyst following may not be a good proxy for information asymmetry for BHCs because BHCs may use more accounting earnings management to meet analyst expectations (Robb (1998)). Flannery et al. (2004) also find that BHC forecasts are always more accurate than nonbank analysts' forecasts.

The key parameters of interest are β_2 and β_3 which capture the dependence of pay-performance sensitivity on asset opacity proxied by shares of loans and trading activities. Both of these coefficients are significantly negative at the 1% level for all specifications including those controlling for BHC size, leverage and CEO attributes. The finding that pay-performance sensitivity decreases as the percentages of loans and trading assets in a BHC's total assets increase on average is inconsistent with Hypothesis H_{1a} that when asset opacity increases monitoring cost, BHCs rely more heavily on high pay-performance compensation contracts to align the interests of the managers with those of the shareholders. However, the finding is consistent with Hypothesis H_{1b} that when asset opacity increases opportunistic behaviors that manager may take, BHCs will trade off pay-performance sensitivity to mitigate shareholder-bondholder conflicts. As Jensen and Meckling (1976) have pointed out the firm is “simply one form of legal fiction which serves as a nexus for contracting relationships”, the managerial compensation in the firm contracts relationships among managers, shareholders, and bondholders (John and John (1993)). As banks’ asset opacity increases, managerial risk-taking behaviors induced by equity-based compensation on behalf of shareholders are difficult to monitor and detect, resulting in potential losses to bondholders (depositors and deposit insurers). A managerial compensation with a lower pay-performance sensitivity is more desirable to depositors and deposit insurers because it can reduce risk-shifting incentives of managers in the interest of shareholders.

The coefficients of interest rate contracts for trading are positive and statistically significant at the 1% level in all specifications. The coefficients of interest rate contracts for non-trading are also positive and statistically significant at the 5% level or better. These results suggest that, on average, pay-performance sensitivity increases as BHCs have more interest rate contracts with respect to their total assets. The reason may be that OBSAs are priced in bank equity as well as subordinated debt, as a result, holding OBSAs such as interest rate contracts can reduce bank risk (hedging derivatives) (Hassan, Karels and Peterson (1994)). Because reduced risk is more desirable for undiversified and risk averse managers, BHCs need to increase pay-performance sensitivity in managerial compensation to allow managers to share more gains with shareholders, and, thus, to encourage managers to pursue the positive NPV projects that may be avoided otherwise.

1.4.2 Endogeneity of Asset Opacity

Our overall results are consistent with the hypothesis that pay-performance sensitivity decreases as a result of greater asset opacity of BHCs. However, managerial incentives (delta) and asset opacity may be jointly determined. Prior research shows that managerial compensation structure has a significant impact on a firm's investment policy (Bebchuk and Fried (2003); Coles, Daniel and Naveen (2006); Palia (2001)). Therefore, some part of the observed association between pay-performance sensitivity and asset opacity may be due to the reason that CEOs with high incentive-based compensation choose to invest in more opaque assets. To address this endogeneity problem, we use the three-stage least square (3SLS) technique to estimate a simultaneous equations model as described below:

$$
\begin{aligned}
Delta_i = {} & \beta_0 + \beta_1 \times TotalAssets_j + \beta_2 \times Loans_j + \beta_3 \times TradingAssets_j + \beta_4 \times ICNT_j + \beta_4 \times ICNNT_j \\
& + \beta_5 \times CashCompensation_i + \beta_6 \times CEOTenure_i + \beta_7 \times CapitalRatio_j + \varepsilon_i \\
Loans_j = {} & \alpha_0 + \alpha_1 \times TotalAssets_j + \alpha_2 \times Delta_i + \alpha_3 \times TradingAssets_j + \alpha_4 \times LargetTimeDeposits_j \\
& + \alpha_5 \times FedFundRate + BHCDummy + \varepsilon_j^{'} \\
TradingAssets_j = {} & \delta_0 + \delta_1 \times TotalAssets_j + \delta_2 \times Delta_i + \delta_3 \times Loans_j + \delta_4 \times InterestIncome_j + BHCDummy + \varepsilon_j^{''}
\end{aligned}
\qquad (2)
$$

According to Angrist and Krueger (2001), an instrumental variable should be highly correlated with the regressor it serves as an instrument for, but unrelated to the error terms in the equation the regressor is used. We follow these criteria in choosing our instruments. Kishan and Opiela (2000) and Romer and Romer (1990) find that large time deposits are among the determinant of total loans. Therefore, we use large time deposits as an instrumental variable for the percentage of loans in total assets. Stiroh (2004) finds that banks shift toward noninterest income activities such as trading as their traditional interest income declines. To address the possibility that interest income is correlated with delta, we use the lagged value of interest income as the instrument variable for the percentage of trading assets in total assets. We also use the BHCs fixed effects to control for unobservable firm characteristics which affect the assets mix.

Table 6 presents the 3SLS parameter estimates of Equation (2). The key parameters of interest are the coefficients of the percentages of loans and trading assets in total assets as determinants of delta. Both coefficients are still negative and statistically significant at the 1% level, indicating that asset opacity has a significant and negative effect on pay-performance sensitivity for managerial compensation in BHCs. Both coefficients of delta in the loan and trading assets equations (columns 2 and 3) are positive and statistically significant at the 5% level or better, suggesting that executives with higher pay-performance sensitivity tend to make more loans and increase trading activities, which increases asset opacity as well as profitability in BHCs. Hence, the association between pay-performance sensitivity and asset opacity is bi-directional in nature and this endogeneity must be accounted for. As managerial compensation with higher pay-performance sensitivity leads to a higher level of asset opacity in banks, potential risk-shifting problems brought about by the higher pay-performance sensitivity are more difficult to detect, thereby increasing the bank risk. In this case, the optimal managerial compensation with the pay-performance sensitivity decreasing in asset opacity is more desirable because such a compensation structure reduces managerial risk-taking incentives, resulting in lower bank risk.

Table 6. Simultaneous Equations Rresults Relating Opaque Assets to CEO Pay-performance Sensitivity

	Delta	Loans	Trading Assets
Intercept	-1.907***	0.456	0.600***
	(-7.22)	(1.22)	(3.11)
Log(Total Assets)	0.119***	-0.008	-0.010
	(8.77)	(-0.39)	(-1.04)
% of Loans	-0.634***		-0.133**
	(-5.11)		(-2.13)
% of Trading Assets	-3.924***	-1.264	
	(-5.95)	(-1.55)	
ICNT/Total Assets	0.027***		
	(4.07)		
ICNNT/Total Assets	0.601***		
	(7.43)		
CEO tenure	0.013***		
	(5.58)		
Cash Compensation	0.113***		
	(8.72)		
Capital Ratio	0.054***		
	(5.80)		
Delta		0.063***	0.014**
		(2.73)	(2.07)
Large Time Deposits		0.001	
		(0.01)	
Fed Funds Rate		0.756***	
		(5.18)	
Lag Interest Income			0.002***
			(2.73)
BHC dummy		Yes	Yes
No. of observations	646	646	646

Note: The t-statistics are based on standard errors within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

1.4.3 Robustness Check

In addition to using the delta, we also measure the pay-performance sensitivity as the dollar change in executive wealth for each $1,000 change in shareholder wealth as defined by Jensen and Murphy (1990), in which shareholder value change measures firm performance. This pay-performance measure assumes that managerial incentives are determined by the dollar change in CEO wealth per dollar change in firm value while using delta as pay-performance measure assumes that managerial incentives come from the CEO's equity stake (stocks and options holdings) in the firm (Baker and Hall (2004)).

Consistent with prior literature, we use two measures of CEO pay. The first measure is referred as total annual compensation, which includes salary, bonus, total value of restricted stock granted, total value of stock options granted, and long-term incentive payouts. It is well recognized that annual compensation is not the primary source of incentives provided to CEOs as they are awarded restricted stocks and stock options as incentive compensation by the board of directors. Hall and Liebman (1998) document a strong relationship between firm performance and CEO wealth change and show that pay-performance sensitivity is largely driven by CEO holdings of stock and stock options. Therefore, we use the summation of the annual compensation and the value change of CEO holdings of stock and stock options as the second measure of CEO compensation. This compensation is denoted as "CEO firm-specific wealth change". It is a broad measure of CEO wealth change specific to his/her firm. We also use CEO's wealth change excluding option value as the dependent variable in our analysis. There are two reasons for this robustness test. First, only in-the-money options are reported in

ExecuComp database. Therefore, ignoring out-of-money options may bias our findings which may have a smaller pay-performance sensitivity. Second, the Black and Scholes (1973) model used to value options may not be appropriate for executive options since executives are unable to diversify their portfolios as other investors can (Hall and Murphy (2002)).

Table 7 reports the regression results. The coefficients of interaction term between shareholder value change and the percentage of loans are significantly negative in all specifications at the 5% level. The coefficients of interaction term between shareholder value change and the percentages of trading assets are also significantly negative in all specifications at the 5% level. The results are consistent with the model using delta as pay-performance sensitivity measure, suggesting that compensation contracts for CEOs in BHCs have a lower pay-performance sensitivity as asset opacity increases. Since the percentages of loans and trading assets are correlated with BHC size, we also estimate a regression of the percentages of loans and trading assets on total assets and then use the residuals in the regressions. In addition, we use total revenue to proxy BHC size. All results are similar in magnitude and significance to those reported earlier.

Table 7. Regressions Relating Opaque Assets to CEO Pay and Wealth Change

	Annual Compensation	Wealth Change excl Options	Wealth Change incl Options
Intercept	-17765.46	-44427.63	28393.00
	(-0.69)	(-0.72)	(0.35)
Log(Total Assets)	2372.58 *	1616.04	-2161.66
	(1.86)	(0.61)	(-0.66)
% of Loans	-6.47	38.60	9.81
	(-0.19)	(0.34)	(0.07)
% of Trading Assets	241.75	732.92	452.78
	(0.76)	(1.35)	(0.48)
ICNT/Total Assets	-2.55	-2.96	-1.78
	(-1.01)	(-0.75)	(-0.33)
ICNNT/Total Assets	9.49	7.93	13.42
	(1.40)	(0.09)	(0.15)
CEO Tenure	822.55 **	204.19	1252.53
	(2.38)	(0.30)	(1.53)
Capital Ratio	12.92	1641.37 **	2259.64 **
	(0.08)	(1.95)	(2.34)
ΔshareholderValue	7.20 **	23.06 **	19.02 *
	(2.24)	(2.29)	(1.69)
ΔshareholderValue*Loans	-6.23	-25.35 **	-30.41 **
	(-1.50)	(-2.31)	(-2.37)
ΔShareholderValue*Trading Assets	-12.85	-58.79 **	-82.91 ***
	(-0.99)	(-2.33)	(-2.7)
ΔshareholderValue*ICNT	0.00	0.13	0.09
	(0.06)	(1.08)	(0.63)
ΔshareholderValue*ICNNT	1.07	5.15 *	9.33 ***
	(0.83)	(1.77)	(3.01)
ΔshareholderValue*Tenure	-0.22	-0.05	-0.24
	(-1.20)	(-0.23)	(-0.96)
ΔshareholderValue*CapitalRatio	-0.27	-0.61	1.55
	(-1.15)	(-0.65)	(1.27)
BHC dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
R-square	0.74	0.36	0.43
No. of observations	651	636	636

Note: The t-statistics are based on standard errors within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

1.5 Conclusion

This paper analyzes the association between pay-performance sensitivity and asset opacity for the CEOs in the banking industry. We find that pay-performance sensitivity decreases as asset opacity intensifies. The rationale is that when asset opacity increases, managers with equity-based compensation may take greater risk on behalf of shareholders since managerial stockholdings and options align the interests of managers with those of shareholders. As a result, depositors and deposit insurers face potential greater losses, resulting in severe risk-shifting problems and higher bank risk. Under these circumstances, the pay-performance sensitivity in the optimal compensation structure decreases as asset opacity increases, reducing managerial risk-taking incentives, and, thus, resulting in lower bank risk. These results continue to hold when we account for endogeneity of both asset choices and managerial compensation structure. We also document that the association between asset opacity and pay-performance sensitivity is bi-directional, with high equity-based compensation resulting in an increase in the percentage of loans in total assets.

The findings have several implications. First, when banking assets are highly opaque and, hence, difficult to monitor, compensation contracts with greater equity incentives may encourage CEOs to act more opportunistically at the expenses of bondholders. This assets substitution problem is more severe given the high leverage in BHCs. Therefore, optimal compensation contracts in BHCs with higher asset opacity would trade off the shareholder-manager incentive alignment to mitigate the conflicts of interest between shareholders and bondholders. Second, the recent financial crisis calls for alignment of compensation with prudent risk taking and engagement of stakeholders.

Our findings suggest that lower pay-performance sensitivity can serve as a pre-commitment device to discourage executives from taking excessive risks. Our findings also suggest pay-performance sensitivity in the banking industry is low because opaque assets in BHCs are unique and costly for outside investors to monitor and value. Hence, to align interests among managers, shareholders and bondholders, BHCs could rely more on other corporate governance mechanisms such as board of directors in addition to managerial compensation contracts. This is consistent with Adams and Mehran (2003) who documents a range of corporate governance differences between BHCs and manufacturing firms, such as larger boards with more committees and a significantly higher percentage of outside directors in BHCs.

CHAPTER 2

BANK STABILITY AND MANAGERIAL COMPENSATION

2.1 Introduction

Stability of the banking sector is a major concern of bank regulators, deposit insurers, and public at large because of the potential contagion across the financial sector and the possible consequent meltdown of the financial system, clearly manifested in the financial crisis of 2007-2009. To mitigate excessive risk taking by banks, the banking industry is subjected to strict regulatory restrictions in terms of capital requirement, geographic and product diversification, asset-liability mix, and mergers and acquisitions. In particular, in the aftermath of the recent financial crisis, the structure of bank executive compensation has received a great deal of attention because of its perceived contribution to the banking turbulence.[3] It is, therefore, important to understand the relationship between firm instability and the executive compensation structure in the banking industry in general, and the incentive features of the top management compensation contracts, in particular, because top managers play a crucial role in decisions concerning "tail risk" which may lead to bank failure and system turmoil.

In this context, Bebchuk and Spamann (2010) argue that stocks and options awarded to bank executives strongly tie their payoffs to bets on the value of bank capital,

[3] Historical legislations to limit bank risk include the Glass Steagall Act (1933) and the Bank Holding Company Act (1956), among others. Recent legislations include the American Recovery and Reinvestment Act (2009) and the Financial Overhaul Bill (2010), both of which contain restrictions on bank executive compensation. The "executive compensation" theory of the crisis was embraced by President Obama, other world leaders and the press following the 2007-2009 crisis (Friedman, 2010).

inducing them to take excessive risk and raising the probability of bank failure. In the same context, when proposing the guidelines designed to ensure that incentive compensation policies do not undermine the safety of banks, Federal Reserve Chairman Ben Bernanke stated that: "*Compensation practices at some banking organizations have led to misaligned incentives and excessive risk-taking, contributing to bank losses and financial instability (Federal Reserve press release, October 22, 2009).*"

Several studies have examined the association between managerial compensation and risk for industrial firms (Agrawal and Mandelker (1987); Core and Guay (1999)). However, results based on industrial firm data cannot be generalized to banks, at least as long as they are operating in a regulated environment, because they have fewer growth options, substantially greater leverage and coverage by the Federal Deposit Insurance Corporation (FDIC). These factors are likely to result in lesser sensitivity of management compensation to bank risk and, thus, lower riskiness of the bank, as detailed in the next section. In support of this view, Houston and James (1995) find that bank CEOs indeed receive a smaller percentage of their compensation in the form of options and stocks, than CEOs in other industries, curtailing the risk sensitivity of their pay. They conclude that the compensation structure in the banking industry does not promote risk taking.

Another strand of the literature, however, finds that since the deregulation of the banking industry in the 1980s, equity-based compensation (EBC), measured by the shares of stocks and options in bank executive compensation packages, has increased (Crawford, Ezzell and Miles (1995); Hubbard and Palia (1995)) and that these greater shares have been associated with greater risk (Chen, Steiner and Whyte (2006); Saunders, Strock and Travlos (1990)). Moreover, the banking industry underwent another major phase of deregulation when the Gramm-Leach-Bliley Act (GLBA, 1999) provided banks with greater growth opportunities through entering into insurance and investment banking fields. Hagendorff and Vallascass (2011) employing data covering both the regulated and less regulated periods (1993-2007) find support for the view that increased incentive-based compensation leads banks to make riskier choices in their mergers and acquisition decisions. This finding is said to be driven by acquisitions benefiting from 'too big to fail' support provisions and those completed after deregulatory steps providing banks with greater risk-taking opportunities. Similarly, DeYoung et al. (forthcoming) employing the data for 1994-2006 report that increased EBC leads to greater riskiness of bank investment choices in the post deregulation period, with this effect being stronger for the large banks. The conflicting findings in the literature on the relationship between executive compensation and risk, recent changes in the regulatory structure, greater potential for financial crisis due to greater interdependencies in domestic and international financial markets and pervasiveness of the recent financial crisis make further investigation of the subject imperative.

The purpose of the current study is to investigate the relationship between riskiness of banks and their executive compensation structure. Our contributions include the following. First, we explicitly estimate the risk incentive feature of managerial compensation, defined as vega of bank CEOs. Vega measures changes in the CEO wealth associated with one percentage point (.01) change in bank stock return volatility (the standard deviation of bank stock returns) and is positively related with EBC. This measure may also be labeled "risk-sensitivity of compensation". By estimating vega, we are able to measure the extent of bank CEO wealth change in response to changes in the bank risk, and, therefore, to better estimate the impact of managerial compensation incentive on bank stability.

Second, we examine the effect of pay-inequality among the top executives on bank stability. This issue is important because although all top executives are responsible for major bank decisions, CEOs have a much greater influence on the process and their incentives play a crucial role in determining the final outcome. The impact of pay-share disparity within the top management team on firm risk has received little attention. Most previous studies have focused on the determinants of the pay-level inequality and pay structure differences between CEOs and the other executives in the top management group, rather than their pay-share and its effect on risk (Aggarwal and Samwick (2003); Ang, Lauterbach and Schreiber (2002)). An exception is Bebchuk et al. (2007), who investigate the relationship between the relative importance of the CEO pay in the top management team and the performance of industrial firms. They find that greater pay fractions of CEOs among the top executives are associated with a lower firm-specific variability of stock returns. In the same context, Ang et al. (2002) find that there does exist a large pay-inequality between CEOs and the rest of the executives in banks, highlighting the importance of understanding the effect of the pay-inequality among top executives on bank stability. The pay share analysis is applied to the banking industry here for the first time and sheds new light on the relationship between pay structure and risk.

Third, we compare managerial compensation between different sized BHCs. Large BHCs are of particular interest because their failures may have a disastrous impact on the financial industry and the economy. As the “too-big-to-fail” (TBTF) status of a

BHC implies greater government support and insurance coverage when it is in distress, depositors of these banks have little incentive to monitor them while their stockholders have greater incentives to encourage risk-taking by the management (O'Hara and Shaw (1990)). Therefore, it is important to examine whether managers in the largest BHCs are awarded compensation packages conducive to greater risk-taking incentives.

Fourth, we explicitly examine the impact of managerial compensation on the bank's insolvency risk. Following Laeven and Levine (2009), we use Z-Score as the primary measure for the overall bank stability. Compared to the market-based risk measures such as the standard deviation of the stock returns or the market beta, Z-Score directly measures the bank's distance from insolvency (the probability of default), which is the primary concern of depositors and deposit insurers. Moreover, we recognize the possible endogeneity problem between vega and risk and employ a simultaneous equation model to address this problem.

We obtain several important results. First, in the banking industry, the CEO wealth sensitivity to stock return volatility (vega) increased beginning in the late 1990s, when banks were allowed to enter into investment banking and insurance activities, fell in 2003, when these new opportunities were possibly exhausted, or vegas were possibly tempered by the bank boards (DeYoung et al. (forthcoming)), and rose again during the crisis perhaps because banking stocks became more volatile (Figure 1). In contrast to prior studies (e.g., Houston and James (1995), but consistent with DeYoung et al. (forthcoming), we find that vegas of bank CEOs are comparable in magnitude to those of their counterparts in industrial firms, indicating that the risk taking incentive features of management compensation structure in banking are similar to those of the latter firms, in spite of its regulated character.

Second, we find a negative and significant association between the CEO vega values and bank stability suggesting that increased sensitivity of bank CEO compensation to stock return volatility, or greater risk-sensitivity of pay, can be destabilizing. Third, the association between vega and the volatility of return on assets (Std (ROA)) is positive and significant, indicating that greater vega values of the bank CEOs are associated with greater bank risk levels. Moreover, the association between vega and the fraction of noninterest income in total income is also positive and significant suggesting that greater sensitivity of the bank CEO compensations to stock return volatility (higher vegas) are associated with larger ratios of off balance sheet activity revenues to total revenues. This is a channel through which bank executives increase bank risk with increased vega serving as the driving force. Overall, these findings suggest that higher sensitivity of CEO wealth to stock return volatility does induce managers to adopt riskier policy strategies, leading to higher return volatility and reduced bank stability.

Fourth, bank stability is associated positively with CEO pay inequality. Specifically, a larger fraction of CEO pay in the top executive team is associated with a lower noninterest income ratio, lower volatility of return on assets (Std (ROA)) and higher bank stability, as measured by the Z-score. Our results suggest that the CEO pay sensitivity level and the CEO pay-share in the top management team have opposite impacts on managerial risk taking incentives. As vega strengthens so does bank risk taking, while when the CEO pay-share rises, CEOs become more risk averse and more powerful, and, thus, implement less risky investment policies, resulting in greater bank stability.

Fifth, using a simultaneous equation framework, we find that the association between managerial compensation sensitivity to risk (vega) and bank stability is bidirectional in nature; higher vegas induce CEOs to adopt riskier policies and increased bank risk also leads to greater vegas. Moreover, larger CEO pay-shares among the top executive team induce CEOs to adopt safer strategies, which in turn, lead to larger CEO pay-shares.

Sixth, we find that vegas vary considerably across different-sized BHCs while the pay-inequality shows minor variation with size. Vegas of the large BHCs are several times higher than those of the small BHCs. More importantly, according to our regression results, the BHC group ranked second in terms of size displays the strongest effect from size on vega. These results suggest that CEOs in the large BHCs have much greater risk-taking incentives than their counterparts in the small BHCs, with a potential for engendering instability in the financial industry and adversely impacting the economy. The finding on the effect of increased size on vega is consistent with the "too-big-to-fail" (TBTF) effect; the managers of the BHCs in the group ranked second in terms of size, are given the greatest incentives to take risk, because they have the highest probability of achieving the TBTF status, and benefiting from increased government guarantees. Finally, market-based risk measures used to investigate the robustness of our results on the relationship between CEO compensation and bank risk reinforce our findings.

The remainder of the paper is organized as follows. Section 2 reviews the related literature and develops the hypotheses. Section 3 describes the data and methodology. Section 4 presents the empirical results and Section 5 concludes.

2.2 Literature Review and Hypothesis Development

2.2.1 Bank Stability and CEO Pay Sensitivity to Risk

The association between managerial compensation and riskiness of industrial firms has been studied by a number of researchers (Amihud and Lev (1981); Coles, Daniel and Naveen (2006); DeFusco, Johnson and Zorn (1990); Smith and Stulz (1985)). Since corporate managers' personal wealth are largely undiversified, they tend to pass up some of the positive net present value (NPV) but risky projects in order to avoid personal risk (Amihud and Lev (1981); Smith and Stulz (1985)). In other words, managerial risk aversion leads to an underinvestment problem. To mitigate this problem, equity-based compensation (EBC) schemes are often used to allow the managers to share the gains from the risky projects with the stockholders. These schemes align the interests of the managers with those of the stockholders and strengthen managers' incentives to adopt risky projects.

As evidence in support of this mechanism, Agrawal and Mandelker (1987) find that managers with more equity holdings do indeed select investments which increase the variance of firm stock returns. DeFusco et al. (1990) also find that after the approval of executive stock option plans, both implied volatility and stock return variance rise. Moreover, Coles et al. (2006) find that the association between managerial compensation structure and firm risk is bi-directional; CEO compensation has a greater sensitivity to firm risk at riskier firms and firms with greater CEO compensation sensitivity to firm risk adopt riskier policies, leading to higher overall firm risk.

CEOs' risk taking incentives in the banking industry have traditionally been dissimilar to the industrial sectors because of a more restrictive investment opportunity set due to the highly regulated nature of the industry, a greater degree of leverage and FDIC coverage. Smith and Watts (1992) argue that because it is harder to directly monitor managers when firms have wider investment opportunity sets (growth options), it is necessary to offer these managers more to tie their personal wealth to respective firms' performances. In the banking industry, the investments opportunity sets were limited by regulatory restrictions, though much less so in the post deregulatory era, such as the post GLBA (1999) period, which allowed banks to enter investment banking and insurance markets. Therefore, proportions of stocks and options in managerial compensation are expected to be lower under regulation, leading to weaker incentives to take risk, and to rise in the post deregulation period.

In addition, since banks are highly leveraged, they are susceptible to greater risk-shifting problem because high leverage allows shareholders to capture most of the gains from the risky projects while the downside risk of those projects is largely born by depositors and deposit insurers (Jensen and Meckling (1976)). As managerial stockholdings and stock options align the interests of managers with those of the shareholders, managers with greater EBC have greater incentives to shift risk on behalf of shareholders. In other words, shareholders of the firms with greater leverage have an incentive to increase their CEOs' EBC to encourage them to increase risk. Hence, increased EBC may aggravate the risk-shifting problem associated with leverage in the banking industry. However, from the viewpoint of depositors, deposit insurers and regulators, for whom the stability of banks is the principal objective, providing bank managers with less EBC is more desirable.

Consistent with the regulation and leverage arguments above, Houston and James (1995) and John and Qian (2003) find that bank CEOs receive a smaller percentage of their total compensation in the form of options and stocks, than the CEOs in other industries. As a result, the personal wealth of bank CEOs are less sensitive to stock performance and volatility and, thus, they have less incentives to take risk. It is notable, however, that EBC for bank CEOs has increased since the deregulation of the 1980s and in particular, since the GLBA (1999) (Crawford, Ezzell and Miles (1995); Hubbard and Palia (1995)).

The increasing trend in EBC for bank CEOs has produced three potential effects. First, as CEOs' compensations have become more sensitive to stock risk in response to increased EBC, their interests are more closely aligned with those of the stockholders and they are more likely to act in stockholders' interests by shifting the risk to depositors, bondholders and deposit insurers (Jensen and Meckling (1976)). In this context, Chen et al. (2006) find that increased option-based executive compensation did indeed increase market risk for a sample of commercial banks during the period of 1992–2000.[4]

Second, John et al. (2000) contend that since banks have a very high leverage and it is difficult to monitor bank assets because of their opaqueness, increased sensitivity of CEO compensation to risk may exacerbate the risk-shifting problem in banks. Third, the

[4] Market risks are measured by: 1) standard deviation of stock returns as the total risk; 2) βM and βI, which are estimated from a two-index (stock market return and risk-free interest rate) market model and used as proxies for the systematic and the interest rate risks, respectively; 3) the standard deviation of the residuals from the market model used as the proxy for the firm-specific risk.

option-pricing model of (Black and Scholes (1973)) implies that the value of an option increases as the stock volatility increases, or, in other words, the payoff of an option is convex. Since CEOs with convex payoffs are more likely to increase firm risk in order to increase the value of their options (Agrawal and Mandelker (1987); Jensen and Meckling (1976)), higher compensation sensitivity to risk provides CEOs with greater incentives to take on risk, resulting in lower bank stability.

The above arguments give rise to the following hypothesis:

H_{1a}: Greater CEO pay sensitivity to risk is destabilizing

However, there are some counter arguments indicating that higher EBC does not necessarily decrease bank stability. First, as the proportion of EBC in total compensation package increases, the executives' personal wealth become more concentrated (less diversified) and more heavily exposed to their own companies' risk. This may make managers more risk averse, partially offsetting the risk taking incentives provided by increased EBC (Guay (1999); Smith and Stulz (1985)).

Second, options, especially those in the money, may discourage risk-taking because of managers' risk aversion. As options move in the money, their payoffs are no longer convex but linear. Since the utility function of risk-averse CEOs is concave, in-the-money options make CEOs averse to an increase in firm risk (Lambert, Larcker and Verrecchia (1991); Parrino, Poteshman and Weisbach (2005)). As options become deep in the money, the risk-reducing effect from the concavity of the manager's utility function could more than offset the risk-increasing effect from the convexity of the compensation scheme (e.g., options). As the value of accumulated options in bank CEOs' total compensation increases considerably, the CEOs may become more risk averse, and, thus, choose less risky projects, resulting in higher bank stability.[5]

Third, if higher net present value (NPV) projects are riskier, increased EBC provides managers the incentives to invest in those risky NPV projects, leading to an increase in the charter value of the bank. As the higher charter value makes it difficult for shareholders to shift losses to depositors and deposit insurers (Keeley (1990)), banks with higher charter values tend to have less risk-shifting problems, thus leading to a higher bank stability. Empirically, Houston and James (1995) document that the association between the use of EBC and the value of the bank's charter (measured by market/book value of bank assets) is positive and significant.

The above arguments give rise to following hypothesis:

H_{1b}: Greater pay sensitivity to risk is stabilizing

2.2.2 Bank Stability and CEO Pay Relative to Other Top Executives

In this section, we develop the hypotheses regarding the association between the pay-inequality among the top executives and bank stability. In theory, a positive or negative association between pay-inequality in the top management and bank risk are both tenable. Conventional economic models suggest that CEO compensation is greater than those of the other top executives because CEOs are more competent and have a firm-wide responsibility (Ang, Lauterbach and Schreiber (2002)). However, this explanation cannot satisfactorily explain the fact that CEO compensations are several

5 Chen et al. (2006) show that the mean value of in-the-money stock options accumulated and held to date for the CEOs is $8,700,130 during the period from 1992 to 2000. The percentage of options in annual compensation has a mean value of 25.88%.

times larger than those of the other top executives (Lazear and Rosen (1981); Main, O'Reilly III and Crystal (1988)). Lazear and Rosen (1981) present a tournament model to explain the large disparity between the pay of CEOs and those of the other executives. They suggest that executives competing to become CEOs are competing in a tournament, where the payoffs of the contestants depend on their relative positions, not on their marginal products. This is because some of the contestants' expected payoffs are put into the winner's prize, which is captured by the CEO, as the winner of the tournament. Since the winner's prize is disproportionately large relative to the contestants' efforts, and risky strategies increase the probability of winning and capturing the prize, the tournament induces the contestants to take on more risks to become the winner (Hvide (2002)). Ang et al. (2002) find that there is indeed a very large and significant compensation gap between the CEO and the rest of the top executives in banking. If this compensation-inequality provides incentives for the executives to choose risky strategies in a tournament, then we expect bank stability to decrease as the compensation-inequality increases:

H_{2a}: An increase in CEO pay-shares in the top management team is destabilizing

Again, some counter argument support the possibility that increased compensation-inequality is stabilizing, rather than destabilizing. Several researchers suggest that contestants in a tournament will have different risk preferences because of their relative positions in the tournament competition (Brown, Harlow and Starks (1996); Ehrenberg and Bognanno (1990)). In a tournament, the payoff is higher than the contestants' marginal products and more so for contestants at lower ranks because they are generally low-paid. Since contestants at lower ranks have greater upside gains from risky strategies, relative to the contestants at higher ranks, while their downside losses are relatively smaller, they are more likely to take on additional risk. However, the contestants at the top have conflicting incentives; although they would like to take risk to capture the larger payoff, they may become risk-averse and prefer to play it safe because they want to avoid the loss of their current sizable pay that could occur if the risky strategy fails. Therefore, the contestants at higher ranks such as CEOs prefer to take less risk in order to lock in their positions. As the fraction of CEOs' compensation in the top management team increases, CEOs become more risk-averse since they face greater downside loss from increased firm risk. Since CEOs are more influential in corporate decision-making process, than other executives, when their compensation share in the top management team increases they become more risk averse, contributing to bank stability as a result.

The above argument gives rise to following hypothesis:

H_{2b}: An increase in CEO pay-share in top management team is stabilizing

2.3 Data and Methodology

2.3.1 Sample and Data

We obtain executive compensation data from the Standard & Poor's Execucomp database. This database provides data on all components of executive compensation (salary, bonus, stock and option holdings) and covers the S&P 1500 plus companies, as well as the companies removed from the S&P1500 index but still trading. Execucomp collects compensation data on up to nine executives, though most companies report only five executives. Execucomp identifies executives as CEOs and documents the dates at which the executive became CEO and he/she left the CEO office. We classify the executives who appear to be the CEO based on these dates, even if Execucomp fails to identify them as the CEO. We use the Federal Reserve's Consolidated Financial Statements for Bank Holding Companies (FR Y9C report) to obtain balance sheet and income data. The Y9C report collects quarterly financial data for BHCs on a consolidated basis in the form of balance sheet, income statement, and detailed supporting schedules. To make a consistent data series with compensation data, we retain the fourth quarter data from the Y9C reports as the basis for the annual data. BHCs' stock price and return data are collected from the Center for Research in Security Prices (CRSP) database.

The sample is constructed as follows. First, we extract all BHCs from the Y9C reports and obtain 733 BHCs. Second, we extract data on all financial firms from Execucomp for the 1992-2008 period, based on SIC codes (6000-6999), and obtain 456 financial firms including BHCs. Third, we manually match the 733 BHCs from the Y9C database with the 456 financial firms from Execucomp by company names and headquarter states. The final sample contains 132 BHCs involving 216 CEOs during the sample period (1992 to 2008), resulting in 1059 BHC-CEO-Year observations.

2.3.2 Variable Construction

We use two risk incentive measures of CEO compensation. First, the vega of CEO option holdings, which measures the CEO personal wealth sensitivity to stock return volatility (risk-sensitivity). Second, the share of CEO total annual compensation in the total annual compensation of the top five executives in the same BHC (pay-share), which measures the pay-inequality in the top management team. We use vega of the CEO's option portfolio because the aggregate sensitivity of CEOs' stock-based wealth to volatility is driven primarily by stock options (Guay (1999)). Following Guay (1999) and Core and Guay (2002), we define vega as the dollar value change in the executive's option portfolio for a 1% change in the annualized standard deviation of stock returns. The same sensitivity measure is adopted in many recent studies including Knopf et al. (2002), Rajgopal and Shevlin (2002), Coles et al. (2006) and DeYoung (2012) . Our calculation of vega follows Guay (1999) and Core and Guay (2002) who use the Black and Scholes (1973) option valuation model, as modified by Merton (1973) to account for dividends. Total compensation comprises salary, bonus, total value of restricted stock granted, total Black-Scholes value of stock options granted, and long term incentive payouts. Bebchuk et al. (2007) use the same measure for CEO pay-share.

We use Z-Score as the primary measure of bank stability. Z-Score is defined as the distance to default and it is calculated as: (ROA+CAR)/σ(ROA), where ROA is the return on assets and CAR is the capital-asset ratio. Assuming profits are normally distributed, Z-Score measures the probability of a negative return that forces the bank to default, that is, the probability of insolvency of a bank at a given time. A higher Z-Score indicates that the bank has relatively more profits to cover its debt liability or a lower default risk. Therefore, Z-Score is the proxy for the distance to default. Following Laeven and Levine (2009), we use the natural logarithm of the Z-Score to measure bank stability since the Z-Score is highly skewed in the sample. For brevity, we use Z-Score in referring to the natural logarithm of the raw Z-Score in the remainder of the paper.

2.3.3 Model and Methodology

If the CEO compensation structure of a BHC has an impact on its stability, we would expect an association between the CEO pay sensitivity to risk (vega) and the BHC insolvency risk (Z-Score). Along the same lines, we would expect an association between the executive pay-inequality and the insolvency risk. Following Chen et al. (2006), our model is specified as follows:

$$
\begin{aligned}
Risk_{i,t} = \beta_0 + \beta_1 \cdot TotalAssets_{i,t} + \beta_2 \cdot Vega_{i,j,t} + \beta_3 \cdot CEOPayShare_{i,j,t} \\
+ \beta_4 \cdot CapitalRatio_{i,t} + \beta_5 \cdot LoanLoss\,\mathrm{Pr}\,ovision_{i,t} \\
+ \beta_6 \cdot AssetConcentration_{i,t} + \mu_t + \varepsilon_{i,t}
\end{aligned}
\quad (3)
$$

Four versions of this model are estimated where $Risk_{i,t}$ is proxied alternatively by the Z-Score of bank *i* in year *t* (in models 1-2) and by the standard deviation of profitability (Std (ROA)) (in model 3-4). $TotalAssets_{i,t}$ is the natural logarithm of total assets and serves as a proxy for the BHC size. $Vega_{i,j,t}$ is a measure of pay-sensitivity of CEO *j* at bank *i* to stock volatility and *CEOPayShare* is the percentage of CEO's annual compensation in the total compensation of the top five executives at the same bank. *CapitalRatio* is the capital-to-assets ratio, which measures capital adequacy (leverage). *LoanLossReserve* is the ratio of the bank's loan loss reserve to total assets and is a measure of credit risk. *AssetConcentration* is the Herfindahl-Hirschman index (HHI) of bank loans, which measures the concentration of bank assets across different loan categories. μ_t is the year dummy.

BHC size is expected to be negatively associated with risk because large BHCs are well established and have more business relations as well as broader business lines and greater protection from the regulators. However, larger banks may use their diversification advantage to pursue riskier businesses resulting in a higher risk level (Demsetz and Strahan (1997)). *CapitalRatio* (total equity capital/total assets), is expected to be negatively related to BHC default risk because a higher capital ratio suggests that the BHC has more equity capital to cover its debt liability and loan losses, and, thus, it is less likely to default. *LoanLossReserve*(loan loss reserve/total assets), is a proxy for loan riskiness and credit risk. A bank making relatively high-risk loans will allocate more funds to loan loss reserve, compared to a bank taking lower risks. Therefore, *LoanLossReserve* is expected to be positively related to bank risk. *AssetConcentration* (Herfindahl-Hirschman index *(HHI)* of bank loans) is a proxy for bank asset concentration (diversification). Traditional banking includes making loans to different economic sectors such as commercial and industrial, real estate, agriculture, financial institutions, individuals, and others. Therefore, we measure BHC asset concentration based on the above loan categories. If assets of a BHC are concentrated in a limited number of loan types, e.g., real estate or commercial loans, the BHC is more likely to be affected by sector-specific factors. Therefore, Asset Concentration (diversification) is expected to be positively (negatively) related to bank risk.

2.3.4 Descriptive Statistics

Table 8 reports the annual statistics for BHCs in the sample for the period 1992-2008. Panel A reports the BHC risk and assets composition data. The BHCs in our sample have the average asset size of $72.23 billion. The asset size is highly skewed to the right as BHCs in the top quartile are several times bigger than median size BHCs. Therefore, we use the natural logarithm of total assets to measure bank size in order to reduce the effect of skewness on our results. The average natural logarithm of the Z-Score is 2.85, which indicates that, on average, profits have to fall by 17 (= $e^{2.85}$) times their standard deviation to deplete bank equity. The mean (median) of ROA is 1.78% (1.81%) with a 5-year average (median) standard deviation of 0.58% (0.55%). The noninterest income of BHCs includes fiduciary income, service charges, trading revenue, foreign exchange transaction income, and other non-traditional banking activities. On average, noninterest income is about 25% of total income. BHCs are highly leveraged; the mean (median) capital ratio is 8.11% (7.91%). The mean (median) ratio of loan loss reserve to total assets is 0.32% (0.23%). BHC total market risk (the annualized standard deviation of daily stock returns for a given year) has a mean of 0.0186 with a standard deviation of 0.009, whereas idiosyncratic risk has a mean of 0.0162 with a standard deviation of 0.074. The average systematic risk, measured by beta from the CAPM, is 1.03.

Panel B of Table 8 reports the summary statistics of the compensation of CEOs and their characteristics. In a given year, the average salary plus bonus for a CEO is $1,346,840, while the mean (median) of annual total compensation is $3,756,340 ($2,004,170). The mean (median) delta value, the increase in the CEO stock and option holdings value for a 1% increase in stock price, is $382,750 ($187,200). This suggests that for a 1% increase in stock price, the CEO stock and option holdings value increases by $382,750 on average[6]. The mean (median) vega is $131,640 ($50,670), suggesting that for 1% increase in stock return standard deviation, CEO option holdings value increases by $131,640 on average. Figure 1 displays the vega of bank CEOs during the period of 1992 to 2008. This figure shows that vega increased in the banking industry in the 1998-2002 period, then fell to rise again during the financial crisis in 2007 and 2008. The increase in the later 1990s may be due to product diversification made possible by

[6] As reported in Table 9, delta and vega are highly correlated as the correlation coefficient is 0.61 and significant at less than 1% level. The high correlation between delta and vega precludes the joint inclusion of both variables in a single regression model.

the Gramm-Leach-Bliley Act (1999), which allowed commercial banks to engage in investment banking and insurance activities, and other deregulatory steps, as well as greater off balance sheet activities (Brewer et al., 2004). In comparison, using executive compensation data from an earlier period, 1992 to 2002, Coles et al. (2006) find that mean (median) vega is 79,586 ($33,610) for CEOs in industrial firms. Our results indicate that CEOs of BHCs have comparable compensation sensitivities to stock volatility as those of the industrial firms. Therefore, the incentive feature of management compensation is similar for banks and industrial firms. Figure 2 shows that the CEO pay-share in the total compensation of the top five executives is relatively stable in the banking industry during 1992 to 2008. The mean (median) CEO pay-share is 0.38 (0.37), indicating that CEO annual compensation represents 38% of the total compensation of the top five executives, on average. These figures indicate that pay-share was not frequently used as an instrument for controlling risk.

Table 9 reports the correlation matrix for primary variables. The bank stability measure (Z-Score) is negatively correlated with vega and positively with the CEO pay-share. These results suggest that bank stability is associated negatively with CEO pay-sensitivity to risk (e.g., due to greater EBC) and positively with pay-inequality among top executives. The pair-wise correlation measures may be highly unreliable indicators of the relationships among our variables of interest because BHC size, loan quality, asset concentration and other attributes are likely to affect bank stability. Hence, we carry out tests of our main hypotheses using a multiple regression framework.

Table 8. Sample Statistics of Bank Assets, Stability and CEO Compensation

Panel A.

	N	Mean	Median	STD	Min	P25	P75	Max
Total assets ($billion)	1059	75.23	16.90	217.46	1.51	6.35	50.86	1,351.52
Z-Score	1059	2.85	2.88	0.28	2.07	2.72	3.03	3.53
ROA (%)	1059	1.78	1.81	0.81	-0.85	1.43	2.15	3.47
ROA standard deviation	1059	0.58	0.55	0.18	0.29	0.47	0.66	1.20
Capital ratio (%)	1059	8.11	7.91	1.72	4.85	7.10	8.83	13.38
Noninterest income/Total income	1059	0.25	0.22	0.13	0.06	0.16	0.30	0.65
Loan loss reserve ratio (%)	1059	0.32	0.23	0.38	0.00	0.12	0.40	1.99
Loan concentration (HHI)	1059	0.41	0.40	0.16	0.02	0.31	0.51	0.93
Stock returns standard deviation (%)	1059	1.86	1.68	0.90	0.82	1.32	2.14	9.60
Beta	1059	1.03	1.00	0.42	0.25	0.73	1.28	2.17
Idiosyncratic risk (%)	1059	1.62	1.46	0.74	0.72	1.17	1.87	7.77

Panel B.

	N	Mean	Median	STD	Min	P25	P75	Max
CEO/Chair duality	1059	0.69	1.00	0.46	0.00	0.00	1.00	1.00
CEO tenure	879	7.04	5.42	5.88	0.00	2.50	10.42	23.92
Salary ($1,000)	1059	570.54	568.44	230.19	150.36	406.01	715.36	1,311.21
Bonus ($1,000)	1059	783.17	345.40	1,325.23	0.00	114.01	860.74	7,242.57
Salary + bonus ($1,000)	1059	1,346.84	870.12	1,397.93	208.78	575.00	1,542.50	7,980.29
Total annual compensation ($1,000)	1054	3,756.34	2,004.17	4,461.84	317.86	1,084.91	4,453.97	22,947.79
Stockholdings ($1,000)	1005	26,046.98	10,706.04	45,516.54	49.23	3,555.12	26,627.91	206,537.36
Option holding ($1,000)	1056	9,378.88	3,531.00	15,014.60	0.00	1,078.76	10,251.26	76,501.17
Delta ($1,000)	1059	382.75	187.20	508.06	0.44	78.36	476.73	2,408.88
Vega ($1,000)	1005	131.64	50.67	209.81	1.42	18.91	142.96	1,087.32
CEO pay-share	1054	0.38	0.37	0.12	0.10	0.32	0.43	0.74

Figure 1. CEO Vega (Pay Sensitivity to Stock Volatility) of BHCs

Figure 2. CEO Pay Share in The Top Management Team of BHCs

Table 9. Correlations between Bank Stability and CEO Compensation

	Z-Score	Std(ROA)	Std(Stock Return)	Beta(market)	Std(residuals)	Total Assets	Delta	Vega	CEO pay-share	Capital ratio	Loan loss reserve	Noninterest income	Loans HHI	cash compensation	CEO tenure	CEO/Chair duality	Number of banks
Z-Score	1.00																
Std(ROA)	-0.70	1.00															
	(0.00)																
Std(Stock Return)	-0.24	0.19	1.00														
	(0.00)	(0.00)															
Beta(market)	-0.21	0.18	0.45	1.00													
	(0.00)	(0.00)	(0.00)														
Std(residuals)	-0.20	0.15	0.96	0.29	1.00												
	(0.00)	(0.00)	(0.00)	(0.00)													
Total Assets	-0.23	0.00	0.01	0.16	-0.06	1.00											
	(0.00)	(-0.90)	(-0.76)	(0.00)	(-0.05)												
Delta	-0.19	0.23	-0.06	0.05	-0.07	0.43	1.00										
	(0.00)	(0.00)	(-0.07)	(-0.11)	(-0.02)	(0.00)											
Vega	-0.25	0.22	-0.02	0.11	-0.09	0.62	0.61	1.00									
	(0.00)	(0.00)	(1.00)	(0.12)	(0.50)	(0.00)	(0.00)										
CEO pay-share	-0.01	0.07	-0.03	-0.05	-0.01	-0.20	0.07	0.03	1.00								
	(-0.85)	(-0.03)	(-0.32)	(-0.09)	(-0.67)	(0.00)	(-0.03)	(-0.37)									
Capital ratio	0.29	0.38	0.13	0.04	0.13	-0.29	-0.03	-0.09	0.03	1.00							
	(0.00)	(0.00)	(0.00)	(-0.15)	(0.00)	(0.00)	(-0.31)	(-0.01)	(-0.42)								
Loan loss reserve	-0.26	0.25	0.53	0.28	0.50	0.22	0.05	0.16	-0.08	0.15	1.00						
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.13)	(0.00)	(-0.01)	(0.00)							
Noninterest income	-0.26	0.27	-0.02	0.15	-0.09	0.41	0.30	0.42	-0.17	-0.09	0.03	1.00					
	(0.00)	(0.00)	(-0.49)	(0.00)	(-0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.00)	(-0.38)						
Loans HHI	-0.01	0.15	0.07	0.05	0.06	-0.46	-0.13	-0.15	0.16	0.22	-0.04	-0.40	1.00				
	(-0.82)	(0.00)	(-0.02)	(-0.12)	(-0.07)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.25)	(0.00)					
Cash compensation	-0.24	0.12	-0.08	0.11	-0.10	0.62	0.46	0.53	-0.06	-0.22	0.04	0.34	-0.29	1.00			
	(0.00)	(0.00)	(-0.01)	(0.00)	(-0.00)	(0.00)	(0.00)	(0.00)	(-0.07)	(0.00)	(-0.17)	(0.00)	(0.00)				
CEO tenure	0.10	-0.11	-0.02	-0.07	0.00	-0.07	0.06	-0.04	0.22	-0.01	-0.08	-0.30	0.15	-0.04	1.00		
	(-0.00)	(-0.00)	(-0.52)	(-0.04)	(-0.95)	(-0.04)	(-0.10)	(-0.30)	(0.00)	(-0.83)	(-0.02)	(0.00)	(0.00)	(-0.25)			
CEO/Chair duality	-0.03	-0.08	-0.14	-0.06	-0.14	0.26	0.17	0.13	0.05	-0.21	-0.09	0.17	-0.20	0.16	0.18	1.00	
	(-0.32)	(-0.01)	(0.00)	(-0.05)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.10)	(0.00)	(-0.00)	(0.00)	(0.00)	(0.00)	(0.00)		
Number of banks	0.11	-0.12	-0.13	-0.07	-0.12	0.50	0.14	0.19	-0.19	-0.01	0.04	0.18	-0.42	0.26	0.03	0.12	1.00
	(-0.00)	(0.00)	(0.00)	(-0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(-0.80)	(-0.24)	(0.00)	(0.00)	(0.00)	(-0.45)	(0.00)	

Note: *P*-values are reported in parentheses below each correlation estimate.

2.4. Empirical Results

2.4.1 CEO Compensation and BHC Stability: A System Model

The association between BHC stability and CEO compensation is described by equation (1) presented earlier. However, the single equation model does not reveal the direction of the underlying causal relationship between vega and bank stability. It is possible that the managerial compensation structure (vega), which is the right-hand-side variable, is affected by the level of risk, the left-hand-side variable, and, hence, the model is subject to endogeneity problems. Risk may influence the managerial compensation structure (vega), e.g., by deepening the information asymmetry between shareholders and managers, thereby raising the cost of monitoring the managers directly. This would make EBC more desirable as it aligns the interests of the managers with those of the shareholders (Holmstrom (1979); Smith and Watts (1992)). Therefore, the negative association between vega and bank stability may be due to the fact that banks with greater information asymmetry choose to reward managers with more equity-based compensation (EBC). It is also possible that, on the contrary, riskier banks react by reducing the EBC to curtail risk taking (De Young,et al. (2012)). Similarly, in a high risk environment, banks might choose to reduce the pay differences among the top management team in order to promote cooperation and to avoid excessive risk-taking (Lazear (1989); Milgrom and Roberts (1988)).

To address the endogeneity issue, we employ a simultaneous equation model with Risk, managerial compensation measure (vega) and the CEO PayShare all treated as endogenous variables. The model, described by Equations 2.A-2.C below, is estimated using the two-stage least squares (2SLS) procedure:

$$\begin{aligned} Risk_{i,t} = {} & \beta_0 + \beta_1 \cdot TotalAssets_{i,t} + \beta_2 \cdot Vega_{i,j,t} + \beta_3 \cdot CEOPayShare_{i,j,t} \\ & + \beta_4 \cdot CapitalRatio_{i,t} + \beta_5 \cdot LoanLossProvision_{i,t} \\ & + \beta_6 \cdot AssetConcentration_{i,t} + \mu_t + \varepsilon_{i,t} \end{aligned} \tag{2.A}$$

$$\begin{aligned} Vega_{i,t} = {} & \alpha_0 + \alpha_1 \cdot TotalAssets_{i,t} + \alpha_2 \cdot CEOPayShare_{i,j,t} + \alpha_3 \cdot CapitalRatio_{i,t} \\ & + \alpha_4 \cdot Risk + \alpha_5 \cdot CashCompensation_{i,j,t} + \mu_t + \varepsilon'_{i,t} \end{aligned} \tag{2.B}$$

$$\begin{aligned} CEOPayShare_{i,j,t} = {} & \gamma_0 + \gamma_1 \cdot TotalAssets_{i,t} + \gamma_2 \cdot Vega_{i,j,t} + \gamma_3 \cdot Risk_{i,t} \\ & + \gamma_4 \cdot Tenure_{i,j,t} + \gamma_5 \cdot CEOChairDuality_{i,j,t} \\ & + \gamma_6 \cdot BankNum_{i,t} + \gamma_7 \cdot BankNum^2_{i,t} + \mu_t + \varepsilon''_{i,t} \end{aligned} \tag{2.C}$$

Following Coles et al. (2006), we include CEO Cash Compensation (salary plus bonus) as the proxy for the CEO’s level of risk aversion in the vega equation (equation 2.B). CEOs with higher cash compensation are more likely to be entrenched and tend to become more risk averse (Berger, Ofek and Yermack (1997)). This effect may be counterbalanced, however, because as entrenched managers become more risk averse, shareholders tend to increase their EBC in order to encourage them to take more risk, resulting in greater pay sensitivity to bank risk (greater vega).

We use CEO tenure and CEO/Chair duality to proxy for the CEO ability in the CEO pay-share equation (2.C). Long tenure and serving as chair on the board indicate that CEO ability is high and, thus, he/she is more competent than other executives in the top management team (Adams, Almeida and Ferreira (2005); Morck, Shleifer and Vishny (1989)). Long tenure and CEO/Chair duality also suggest CEO’s dominant position within the top management team. Therefore, we expect a positive relationship between CEO pay-share and his/her tenure as well as CEO/Chair duality. In addition, we use the number of banking subsidiaries of a given BHC to proxy the number of contestants in the tournament competition.[7] Since contestants give up some of their expected compensation, which goes to the winning prize as the CEO compensation, we expect the CEO pay-share in the total compensation of the top executives to rise as the number of contestants increases. The squared term of this variable captures possible nonlinearity in the model.

Table 10 presents the results for the system model (2.A-2.C), which accounts for endogeneity of Z-Score, vega and pay-share variables. The coefficient estimate on vega in the Z-Score equation (2.A) is negative and significant at the 1% level (column 1) indicating increased risk in response to a greater values of vega. The coefficient of vega when using the Std (ROA), instead of Z-Score, is commensurately positive and significant (column 4). These results support hypothesis H_{1a} purporting that greater CEO pay sensitivity to risk is destabilizing. H_{1b} is opposed. In the same equation, the coefficient of the CEO pay-share is positive and significant indicating that greater inequality of pay between the CEO and other executives (greater CEO pay-share) is risk-reducing. This result is consistent with the hypothesis (H_{2b}) purporting that when CEO receives a greater share of compensation in the top management team, he/she becomes more risk averse and implements less risky strategies. H_{2a} is opposed.[8]

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[7] All top executives of BHC subsidiaries can compete for the CEO's job but it may well be that only the top few are serious contenders. While other executives and outsiders may also be in the competition, the number of banking subsidiaries offers a reasonable approximation for the number of participants.

[8] A single-equation model is also estimated. In this model, the coefficient of pay-share in the Std (ROA) is negative. The dissimilarity in findings between the single-equation and system models indicates that endogeneity must be accounted for and that the latter model is superior.

Table 10. System Model Relating Bank Stability (Z-score) to Executive Compensation

	Model 1: Z-Score and CEO compensation			Model 2: Std (ROA) and CEO compensation		
	Z-Score	Vega	CEO pay-share	Std (ROA)	Vega	CEO pay-share
Intercept	-0.490	-0.630***	0.232	2.649***	-2.050***	1.008***
	(0.402)	(0.199)	(0.157)	(0.247)	(0.151)	(0.183)
Total Assets	0.160***	0.088***	-0.004	-0.122***	0.095***	-0.032**
	(0.020)	(0.006)	(0.007)	(0.011)	(0.005)	(0.010)
Vega	-1.723***		-0.018	1.250***		0.224**
	(0.173)		(0.067)	(0.094)		(0.102)
CEO pay-share	1.041***	0.439**		-0.970***	0.720***	
	(0.360)	(0.203)		(0.227)	(0.186)	
Capital Ratio	0.071***	0.032***		0.024***	0.018***	
	(0.007)	(0.004)		(0.005)	(0.004)	
Loan Loss Reserve	-0.085***			0.014		
	(0.023)			(0.010)		
Asset Concentration	-0.013			0.002		
	(0.047)			(0.022)		
Z-Score		-0.410***	0.084**			
		(0.052)	(0.033)			
Std (ROA)					0.761***	-0.154***
					(0.057)	(0.058)
Cash Compensation		0.007**			0.005**	
		(0.004)			(0.003)	
CEO Tenure			0.004***			0.003***
			(0.001)			(0.001)
CEO/Chair Duality			0.013*			0.010
			(0.008)			(0.008)
Number of banks			-0.038***			-0.035***
			(0.010)			(0.010)
Number of banks ^ 2			0.008***			0.008***
			(0.003)			(0.003)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	824	824	824	824	824	824

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

These results show that CEO compensation sensitivity and CEO pay-share have opposite effects on risk. As increased CEO's personal wealth sensitivity to stock risk (greater EBC) aligns his/her interest with those of the shareholders, the CEO will have stronger incentives to take risk at the expense of depositors, bondholders and deposit insurers, lowering bank stability as a result. However, as the CEO pay-share rises, the CEO, now facing a potentially greater loss from risk-taking, will become more risk averse and will implement safer investment policies, leading to higher bank stability. [9]

In the vega equation (2.B), Z-Score carries a negative sign while Std (ROA) carries a positive sign and both are significant at the 1% level. In the CEO pay-share equation, Z-Score carries a positive sign while Std (ROA) has a negative sign and they are significant at the 5% and 1% level, respectively. These results suggest that the relationship between risk and compensation are indeed bi-directional; greater EBC leads to greater sensitivity of management compensation to firm risk (vega) and heightens firm risk, and greater firm risk leads to greater EBC and, hence, increased sensitivity of management compensation to firm risk (vega). The positive relation between vega and risk is consistent with Coles et al. (2006) finding that riskier firm strategies generally lead to higher compensation sensitivity to risk. On the other hand, riskier banks have a more compressed compensation policy in the top management team, in the sense that the CEO pay-share is a smaller proportion in the total compensation of the top executives. This result suggests that when bank stability deteriorates, a compressed compensation scheme

[9] This latter finding has implications on regulations altering the relative CEO pay by imposing differential limits on the total compensations of CEOs and other executives.

may be adopted to promote cooperation among the top executives and to reduce risk-taking. CEOs may even voluntarily support this scheme to demonstrate leadership.

Among the control variables, total assets (bank size), is positively associated with Z-Score and negatively with volatility of ROA (Std (ROA)). Both estimates are significant at the 1% level, suggesting that larger banks are less risky. The explanation may be that larger BHCs have more business connections and a broader and more diversified set of operations, which contribute to their greater stability. Moreover, the TBTF effect improves the perception of riskiness of these entities in the eyes of the market participants. The capital-to-assets ratio, a measure of capital adequacy, shows conflicting results on the two measures of risk; it increases both the Z-Score and the volatility of ROA and the estimates are significant at the 1% level. The positive association of capital ratio with the Z-Score occurs because higher capital ratios are an indication that BHCs have a greater level of equity to cover their debt liabilities and, thus, they face a lower default risk. The explanation for the positive association between the capital ratio and Std (ROA) may be that BHCs become more daring in increasing their risky investments when they have more capital available.

Loan loss reserve ratio, a measure of loan riskiness (credit risk), carries a negative sign in the Z-Score equation and it is significant at the 1% level. This result is intuitive as increased riskiness of loans elevates the probability of bank insolvency. However, this variable is statistically insignificant in the Std (ROA) model, perhaps because it does not capture the default risk well. Asset concentration has an insignificant coefficient in the Z-Score equation, suggesting that asset diversification (concentration) does not impact bank stability. This may be because bank assets are so heavily concentrated in real estate and commercial loans that shifts from one of these loan categories to the other does not improve the risk position of the bank.[10]

In the vega equation, the coefficient estimate on cash compensation, a measure of the CEO's level of risk aversion, is positive and significant at the 5% level. This suggests that as CEOs become more risk averse, shareholders increase their managerial risk-taking incentives by raising their EBC to counter the effect, thus leading to higher managerial compensation sensitivity to risk (vega).

In the CEO pay-share equation (2.C), CEO tenure and CEO/Chair duality are positive and significant at the 1% and 10% levels, respectively. These results indicate that if CEOs are in office longer, or if they serve also as chair of the board, their compensation represents a larger proportion of the total compensation of the top management team. This is because they are more experienced and more influential than the other executives. The coefficient estimate on the number of banks in the pay-share equation is negative while that on the squared term is positive, with both being significant at the 1% level. These results show that the pay-inequality is convex; as the number of contestants in the tournament increases, the pay-share (pay inequality) decreases but at a decreasing rate. This suggests that when the number of banks within a BHC increases, the pay-inequality is reduced in order to promote cooperation. However, as the number of banks continues to grow, more executives will compete in the tournament and will give up some of their expected compensation as part of the CEO's salary, thus weakening the

[10] According to Saunders and Cornett (2010), the total share of commercial and industrial and real estate loans in total loans was 73% in 2007 among large banks.

reduction in inequality or increasing the pay-inequality between CEO and the other executives.

2.4.2 Effect of CEO Compensation on Noninterest Income Activity

In this section, we investigate the relationship between noninterest income of BHCs and the compensation structure of their CEOs to determine whether banks use noninterest income activities as a channel to elevate their risk taking in response to increased levels of EBC (vega). We argue that if the CEO compensation structure has an impact on managers' risk preference, we should observe that banks with greater pay sensitivity to risk (vega) engage in a greater levels of non-traditional banking businesses as a channel to achieve a greater level of risk. Following Stiroh (2004), we use the percentage of noninterst income in the total BHC income to proxy for the non-traidtional banking activities. Noninterest income derives primarily from fee-based activities. It is comprised of four primary components: fiduciary income, service charges, trading revenue including revenues from derivatives activities, and fees and commissions. Detailed breakdown of noninterest income is available in the Y-9C reports.

Noninterest income has been growing steadily over time as BHCs have shifted away from lending toward activities that generate fee income, service charges and trading revenue. This shift toward non-traditional businesses has widened the scope of bank operations, allowed them to limit or expand their exposure to interest rate, exchange rate and other risks and permitted them to avoid regulations such as reserve requirement and deposit insurance with the purpose of producing greater and more diversified revenues. However, recent research finds that noninterest income is associated with higher, rather than lower, risk (Stiroh (2004); Stiroh (2006)). Besides, Brewer et al. (2003) have found that increased off balance sheet activities increases bank opacity, complicates the monitoring of the managers and leads to greater EBC and, hence, greater vega. Therefore, if greater pay-sensitivity to risk (higher vega) induces greater risk-taking by the management, we expect a positive association between noninterest income and vega. The model is described by equations (3.A-3.C) and it is estimated using the 2SLS procedure:

$$\begin{aligned} Noninterest Income_{i,t} &= \beta_0 + \beta_1 \cdot TotalAssets_{i,t} + \beta_2 \cdot Vega_{i,j,t} \\ &+ \beta_3 \cdot CEOPayShare_{i,j,t} + \beta_4 \cdot CapitalRatio_{i,t} \\ &+ \beta_5 \cdot LoanLoss_{i,t} + \beta_6 \cdot AssetConcentration_{i,t} + \mu_t + \varepsilon_{i,t} \end{aligned} \tag{3.A}$$

$$\begin{aligned} Vega_{i,t} &= \alpha_0 + \alpha_1 \cdot TotalAssets_{i,t} + \alpha_2 \cdot CEOPayShare_{i,j,t} + \alpha_3 \cdot CapitalRatio_{i,t} \\ &+ \alpha_4 \cdot Noninterest Income_{i,t} + \alpha_5 \cdot CashCompensation_{i,j,t} + \mu_t + \varepsilon'_{i,t} \end{aligned} \tag{3.B}$$

$$\begin{aligned} CEOPayShare_{i,j,t} &= \gamma_0 + \gamma_1 \cdot TotalAssets_{i,t} + \gamma_2 \cdot Vega_{i,j,t} + \gamma_3 \cdot Noninterest Income_{i,t} \\ &+ \gamma_4 \cdot Tenure_{i,j,t} + \gamma_5 \cdot CEOChairDuality_{i,j,t} \\ &+ \gamma_6 \cdot BankNum_{i,t} + \gamma_7 \cdot BankNum^2_{i,t} + \mu_t + \varepsilon''_{i,t} \end{aligned} \tag{3.C}$$

Table 11 presents the regression results. The coefficient estimates on variable vega in the noninterest income equation (3.A) is positive and significant at the 1% level, indicating that BHCs with more risk-sensitive CEO compensation structure (greater vega) do indeed engage in greater levels of non-traditional banking activities when size and other relevant variables are accounted for. In the same equation, the coefficient estimates on the pay-share variable is negative and significant at the 1% level, indicating that increased CEO pay-share reduces the level of non-traditional banking activities. These results are consistent with our expectations and our earlier findings. CEO compensation sensitivity to risk and CEO pay-share have opposite impacts on managerial risk-taking behavior through the noninterest-income activity channel. High CEO compensation sensitivity to risk (greater vega) provides stronger incentives to implement risky investment policies, including non-traditional banking activities, while a larger CEO pay-share makes the CEO more risk averse and curtails these activities. All other estimates are qualitatively and quantitatively similar to the prior findings. Other possible channels of increasing risk, in response to increase CEO pay sensitivity and pay-inequality, include an increase in the share of loans in total assets at the expense of liquid assets, switching from safer to riskier loans such as commercial and industrial loans, changing the mix of loans within each category towards loans with greater default risk, and increasing out of state and international activities.

Table 11. System Model Relating Noninterest Income to Executive Compensation

	Noninterest income	Vega	CEO pay-share
Intercept	1.640***	-1.524***	0.512***
	(0.226)	(0.163)	(0.118)
Total Assets	-0.054***	0.080***	-0.006
	(0.011)	(0.006)	(0.007)
Vega	0.592***		-0.012
	(0.103)		(0.070)
CEO pay-share	-0.849***	0.149	
	(0.160)	(0.215)	
Capital Ratio	-0.006*	0.016***	
	(0.003)	(0.003)	
Loan Loss Reserve	-0.038***		
	(0.012)		
Asset Concentration (HHI)	-0.366***		
	(0.037)		
Noninterest income		0.012	0.028
		(0.099)	(0.075)
Cash Compensation		0.031***	
		(0.005)	
CEO Tenure			0.005***
			(0.001)
CEO/Chair Duality			-0.005
			(0.008)
Number of banks			-0.051***
			(0.011)
Number of banks ^ 2			0.011***
			(0.003)
Year dummy	Yes	Yes	Yes
N	810	810	810

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

2.4.3 CEO Compensation, Bank Size and BHC Stability

The association between bank risk-taking and CEO compensation structure (vega) is particularly important as it relates to the large BHCs because failure of these firms could create a contagion, exerting a ruinous impact on the financial industry and the economy at large. These effects may even spillover across the national borders to produce a worldwide financial crisis such as the one witnessed in 2007-2009. Moreover, since the TBTF status of large BHCs implies a greater possibility of government assistance, depositors of large banks have little incentive to monitor the risk-taking of banks, and stockholders have greater incentives to encourage risk-taking by the management to produce greater earnings (O'Hara and Shaw (1990)). The combined effects of these forces could elevate bank risk substantially. [11]

As a greater vega induces managers to take greater risk, one would expect that large BHCs arrange for their CEOs to have high vegas (greater EBC) in order to maximize the value of the implicit government guarantee. Deng et al. (2007), however, argue that the TBTF effect does not increase in a monotonic manner with bank size. Specially, the medium-sized banks benefit more from TBTF effect, than either the large-sized or the small-sized banks, because the former may have already achieved the TBTF status and the latter are far away from it. Along the same lines, Penas and Unal (2004) document that medium-sized banks realize the highest returns in mergers compared to small-sized and large-sized banks, at least partly because they get closer to the TBTF

[11] To limit the TBTF effect, the Wall Street Reform and Consumer Protection Act (2010) gives the Fed the power to break up a systemically important company, which poses a “grave threat” to financial stability.

status. Deng et al. (2007) also find that medium-sized BHCs experience a greater reduction in the cost of debt from diversification than small and large BHCs, for the same reason. Along these lines, we propose that if there is a TBTF effect from vega-induced risk taking, BHCs in the size group below the largest size would increase vega the most because they have the greatest potential to achieve the TBTF status, and, thus, to benefit from the implicit government guarantees.

To examine the TBTF effect, we divide BHCs into five quintile groups by the size of total assets. The first quintile group contains the smallest BHCs in the sample while the fifth includes the largest ones. Panel A of Table 12 reports the BHC size and CEO compensation statistics for each quintile group. The asset size is highly skewed as the average size of the fifth BHC quintile (largest-size) is $294.81 billion, which is two orders of magnitude larger than those of the smallest two quintiles. The asset size of the fifth BHC quintile is even several times larger than that of the fourth BHC quintile, which has the average total assets of $44.41 billion. The first, the second and the third quintiles have average total assets of $3.79 billion, $7.83 billion and $17.73 billion, respectively.

The average vega of the group of the largest BHCs is $341,320, suggesting that for 1% increase in standard deviation of stock return, the option holdings value increases by $341,320 on average for the CEOs. The first, the second, the third, and the fourth quintiles have the average vega values of $34,220, $45,960, $69,160, and $157,240, respectively. These figures show that as BHCs grow larger, their CEOs' option values become more sensitive to stock return volatility, indicating that compensation structures of CEOs in larger BHCs are set up to have higher vegas in order to promote risk-taking. The average CEO pay-share in the top management team declines as the size increases though it is rather similar across different sized BHCs. The average pay-share in the group of largest BHCs is 0.34, which is the lowest. The first and the second quintiles (the smallest BHCs) have the average CEO pay-share of 0.40, while the third and the fourth quintiles have the average CEO pay-share of 0.39 and 0.37, respectively.

Panel B of Table 12 reports the differences of vegas and CEO pay-shares across the quintile groups. The Bonferroni multiple comparison test is used to identify the differences between each pair of means. The differences in vegas between the small BHCs (first, second and third quintiles) are insignificant. However, the largest two BHC groups (fourth and fifth quintiles) have much higher vegas than the other three groups, and the differences are significant at the 1% level between them and the smaller banks as well as between themselves. In particular, the vega of the largest BHCs is $184,080 greater than that in the group of the second largest BHCs, suggesting that for 1% increase in stock return volatility, CEOs in the largest BHCs are awarded $184,080 more than their counterparts in the quintile of the next largest BHCs. The average vegas of the largest two BHC groups are several times higher than those of the bottom three quintiles, suggesting that to take advantage of the government subsidies, the largest bank group provides the highest risk-reward (vega) to its executives than those in the other BHC groups. Pay-share differences are found to be insignificant among the smaller BHCs but significant between them and the larger BHCs, with the latter taking lower pay-share values. The differences in pay-shares are highly significant between smaller and larger quintiles and more so for the largest-size BHCs. The relatively lower CEO pay-share in the large BHCs suggests that they have less incentive to choose safer investment policies. This provides a policy instrument for the regulators to discourage bank risk.

Table 12. CEO Compensation of Different Sized BHCs

Panel A. Sample statistics of different sized BHCs

BHCs size quintile	Total Assets (billion)		Vega (thousand)		CEO pay-share		No. of Obs
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
1	3.79	1.43	34.22	55.37	0.40	0.14	197
2	7.83	2.22	45.96	71.74	0.40	0.11	205
3	17.73	6.58	69.16	77.50	0.39	0.10	199
4	44.41	22.26	157.24	183.36	0.37	0.11	193
5	294.81	411.31	341.32	318.81	0.34	0.09	211
Total	75.23	217.46	131.64	209.81	0.38	0.11	1005

Panel B. Comparison of vega and CEO pay-share between different sized BHCs

BHCs size quintile	Vega				CEO pay-share			
	1	2	3	4	1	2	3	4
2	11.74				0.00			
	(1.00)				(1.00)			
3	34.94	23.20			-0.01	-0.01		
	(0.47)	(1.00)			(0.47)	(1.00)		
4	123.02***	111.27***	88.08***		-0.03**	-0.03**	-0.02	
	(0.00)	(0.00)	(0.00)		(0.03)	(0.02)	(0.00)	
5	307.10***	295.36***	272.16***	184.08***	-0.05***	-0.05***	-0.04***	-0.02
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.44)

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

To more accurately test the TBTF effect on CEO risk taking incentives (vega), we estimate two extensions of the system model (2.A-2.C). In model 1, we include the square term of BHC size and in model 2, we further add two size dummy variables, DumNextLarge and DumSmall, and interact them with BHC size (total assets). The two size dummies take the unit value for the BHCs whose total assets belong to the fourth quintile and the smallest three quintiles of the sample, respectively, and zero otherwise. The largest size group (5^{th} quintile) is the benchmark. The reason for assigning the smallest three quintiles to the same group is that these BHCs are similar in terms of both size and vega. The fourth quintile is of particular interest because this quintile is the second largest in the sample and BHCs in this group have the potential to achieve the TBTF status. Accordingly, this BHC group should show the largest vega increment, namely that it should increase the risk-reward the most, aiming to be in the TBTF group. Analytically, the CEO risk-taking incentives (vega) of this BHC group should be more strongly affected by changes in BHC size, than that of the benchmark group.

As the results for the vega equation (equation 2.B) in Model 1 of Table 13 show, the coefficient estimate on the total assets of banks is positive while that on its squared term is negative, with both estimates being significant at the 5% level. These results show that vega increases with BHC size but at a declining rate; demonstrating a non-monotonic pattern of size dependence. In other words, larger banks offer their CEOs pay arrangements with greater risk incentives but only up to a certain size. Consistent with our prior findings, bank size has no effect on the CEO pay inequality.

Table 13. Executive Compensation, Bank Size and Stability

	Model 1			Model 2		
	Z-score	Vega	CEO pay-share	Z-score	Vega	CEO pay-share
Intercept	2.152	-4.872**	1.931	-2.413	-2.926	0.118
	(2.886)	(1.949)	(1.410)	(3.226)	(1.875)	(1.805)
TotalAssets	-0.149	0.560**	-0.204	0.256	0.179*	0.002
	(0.324)	(0.226)	(0.151)	(0.164)	(0.093)	(0.084)
TotalAssets^2	0.009	-0.014**	0.006			
	(0.009)	(0.007)	(0.004)			
TotalAssets*DumNextLarge				0.009	0.019**	-0.006
				(0.014)	(0.008)	(0.010)
TotalAssets*DumSmall				0.024	0.028	0.003
				(0.037)	(0.022)	(0.017)
Vega	-1.555***		-0.052	-1.488***		0.038
	(0.236)		(0.069)	(0.235)		(0.083)
CEO pay-share	1.095***	0.098		1.079**	0.334	
	(0.408)	(0.255)		(0.421)	(0.282)	
Capital Ratio	0.078***	0.024***		0.081***	0.029***	
	(0.008)	(0.005)		(0.011)	(0.006)	
Loan Loss Reserve	-0.180***			-0.189***		
	(0.032)			(0.033)		
Z-score		-0.228***	0.083*		-0.253***	0.090**
		(0.068)	(0.046)		(0.074)	(0.035)
Cash Compensation		0.041***			0.032***	
		(0.009)			(0.008)	
CEO Tenure			0.003***			0.003***
			(0.001)			(0.001)
CEO/Chair Duality			0.026**			0.037
			(0.013)			(0.026)
Number of banks			-0.043***			-0.038***
			(0.014)			(0.015)
Number of banks ^ 2			0.007***			0.006**
			(0.003)			(0.003)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
N	824	824	824	824	824	824

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

In Model 2 of Table 13, the impact of size on vega of the largest banks is the base case and, hence, it is reflected in the total assets itself. We find that in the vega equation, the coefficient estimate of the total assets remains positive and significant at the 10% level, suggesting that CEOs' risk taking incentive increases with the size of BHCs. The more interesting finding, however, is that the coefficient estimate of the interaction term (TotalAssets×DumNextLarge) is positive and significant at the 5% level, while the coefficient of the interaction term (TotalAssets×DumSmall) is insignificant. According to the former result, the size effect on vega of the BHCs in the second largest group of BHCs is greater than that of the BHCs in the largest group. Specifically, on average, BHCs ranked second in terms of size award their CEOs $72,075 more for 1% increase in stock return standard deviation.[12]

These results support the TBTF effect, suggesting that the second largest BHCs increase vega the most in order to encourage the bank management to take greater risks and to, thereby, achieve the TBTF status and to benefit from increased government guarantees. Further, it is notable that some of the BHCs in the largest group may not possess the TBTF status. Switching these banks to the fourth quintile would only strengthen our result.

2.4.4 Effect of CEO Compensation on BHC Market Risk

As a robustness check, we examine the relationship between the CEO compensation structure and bank risk taking using market-based risk measures. The

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[12] The average size of the second largest BHC group is $44.41 billion. The coefficient of the interaction term (Ln (TotalAssets)×DumNextLarge) is 0.19. Therefore, on average, the additional vega awarded to CEOs in the second largest BHC group is 0.19× Ln (44.41), which is 72.075 (thousand).

market risk measures are estimated for each year using weekly data from the relevant year, obtained from CRSP. We calculate three market-based risk measures; total risk is the standard deviation of the stock returns; systematic risk is the beta obtained from the CAPM, and idiosyncratic risk is the standard deviation of the residuals obtained from the CAPM. Laeven and Levine (2009), Saunders et al. (1990), and Esty and Megginson (2003) use similar measures. One advantage of the market measures is that, compared to accounting-based measures, they incorporate all of the current and expected future value creation information. One disadvantage is that market data are relatively noisy and do not directly measure the insolvency risk as Z-Score does.

Table 14 presents the results for the system model (equations 2.A-2.C) based on market measures of risk. The coefficient estimate on vega in the risk equation (2.A) is positive and significant at the 5% level or better for all three risk measures, suggesting that increased CEO compensation sensitivity to risk (vega) is associated with an increases in a bank's total, systematic, and idiosyncratic risk measures. The coefficient estimate on the CEO pay-share in the same equation is negative and significant at the 10% level for the total and idiosyncratic risk while it is insignificant for the systematic risk model, indicating lower risk when CEO pay-share (pay inequality) is greater. These results are consistent with our prior findings on vega, suggesting that increased sensitivity of CEO's personal wealth to risk provides them with incentives to take on more risks. CEO's compensation relative to other executives has an effect on managerial risk taking incentives, which is contrary to that of vega; greater pay-shares make CEOs more risk averse and lead to less risky investment policies. This result is consistent with Bebchuk et al. (2007) who find that a greater CEO pay-share is associated with a lower firm-specific risk. All the other coefficient estimates are similar to our prior findings.

2.5 Conclusion

In this study, we assess the association between the managerial compensation structure and bank stability (risk). To this end, we examine the risk-taking incentive features of CEOs' compensation packages (vega) as well as the compensation structure of the top management of BHCs in association with BHC insolvency and market-based risk measures. We show that, unlike the early finding in the literature (Houston and James (1995)), pay sensitivities of BHC CEOs to stock return volatility are comparable with those of the industrial firms. We also find that higher sensitivity of CEO wealth to stock return volatility (greater vega or greater EBC) induces the CEOs to implement riskier policies, such as increasing non-traditional banking activities, leading to higher return volatility and lower bank stability. On the other hand, CEOs become more risk averse as their share of compensation in the top executive team increases and, consequently, they implement safer investment policies. Further, using a simultaneous equation framework, we find the association between managerial compensation structure and bank stability to be bi-directional; more risk-sensitive compensation packages lead to riskier investment policies and riskier banks adopt managerial compensation structures, which are more sensitive to stock return volatility.

Table 14. System Model Relating Market-based Risk Measures to Executive Compensation

	Risk Measure = Total Risk			Risk Measure = Market Risk			Risk Measure = Idiosyncratic Risk		
	Std(Return)	Vega	Pay-share	Beta(Market)	Vega	Pay-share	Std(Residuals)	Vega	Pay-share
Total Assets	-0.002	0.081***	-0.017**	-0.095***	0.080***	-0.017**	-0.002	0.081***	-0.017**
	(0.002)	(0.006)	(0.008)	(0.036)	(0.006)	(0.008)	(0.001)	(0.006)	(0.008)
Vega	0.031**		0.067	0.969***		0.093	0.026**		0.063
	(0.014)		(0.077)	(0.330)		(0.086)	(0.013)		(0.078)
CEO pay-share	-0.081*	0.231		-0.284	0.274		-0.079*	0.222	
	(0.047)	(0.198)		(0.964)	(0.205)		(0.043)	(0.197)	
Capital Ratio	-0.001***	0.016***		-0.015	0.015***		-0.001***	0.016***	
	(0.000)	(0.003)		(0.011)	(0.003)		(0.000)	(0.003)	
Loan Loss Reserve	0.012***			0.232***			0.009***		
	(0.003)			(0.055)			(0.002)		
Risk		1.649	-1.289		0.142**	-0.078*		1.811	-1.638
		(1.050)	(0.802)		(0.059)	(0.047)		(1.294)	(1.010)
Cash Compensation		0.032***			0.029***			0.032***	
		(0.005)			(0.005)			(0.005)	
CEO Tenure			0.003***			0.004***			0.003***
			(0.001)			(0.001)			(0.001)
CEO/Chair Duality			0.014*			0.014*			0.013
			(0.008)			(0.008)			(0.008)
Number of banks			-0.048***			-0.042***			-0.049***
			(0.010)			(0.011)			(0.010)
Number of banks ^ 2			0.012***			0.010***			0.012***
			(0.003)			(0.003)			(0.003)
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	824	824	824	824	824	824	824	824	824

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

When the sample is disaggregated by BHC size, we find that vega of the large BHCs is several times higher than that of the small BHCs. As higher vega induces greater risk taking, this finding suggests that risk-taking incentives of CEOs in the large BHCs are much greater than those in the small BHCs and that this feature may heighten systemic risk. More interestingly, consistent with the "too-big-to-fail" (TBTF) effect, we find that the BHCs ranked second in terms of size raise the risk-sensitivity of their management compensation packages (vega) to exceed those in the largest and small-size banks in order to increase their risk taking incentives, and, thereby, the chances of achieving the "too-big-to-fail" status. The rationale is that these BHCs count on underpriced government guarantees and the high probability of bailouts. Finally, we reaffirm these findings using three market-based risk measures.

These results have major implications for depositors, deposit insurers, regulators and investors in stocks of the banking industry. Since the incentive features of management compensation structures in banking (vegas) have strengthened to become similar to those in the industrial firms, they induce stronger risk taking and greater probability of undermining the stability of the banks and the financial system as a whole, than they did in earlier decades. Hence, it is important for large depositors and deposit insurers to consider these incentive features into in pricing dedeposits and insurance premiums, respectively. Consistent with the argument offered by Bebchuk and Spamann (2010), bank regulators should actively monitor and mitigate risk-taking incentives of managerial compensation, especially the largest banks, in order to enhance bank stability and curtail the chances of systemic meltdown. As large banks' TBTF status implies greater government support, shareholders of large banks have greater incentives to encourage risk taking by the management, and, thus, awarding managers with higher-vega compensation packages to maximize the value of implicit government guarantees. Vega of CEOs in the large BHCs is several times higher than that of CEOs in the small BHCs, suggesting that CEOs in the large BHCs have much greater risk-taking incentives, posing a threat to the stability of the financial industry and the economy. It is likely that these factors have indeed contributed to the financial crisis witnessed in 2007-2009.

CHAPTER 3

RISK COMMITTEE, BANK BUSINESS POLICY AND RISK

3.1 Introduction

Risk management of banks has received much greater attention after the recent financial crisis, which began in 2007 and lasted till 2009 with lingering effects up to today. Between January 2008 and June 2012, 417 U.S banks and thrifts with total assets of more than $677 billion failed, causing an estimated loss of more than $82.1 billion for the FDIC[13]. To examine the risk-taking incentives of banks, several recent studies have investigated the compensation structure of bank executives (Bai and Elyasiani (2012); DeYoung, Peng and Yan (forthcoming); Hagendorff and Vallascas (2011)). These studies find evidence that the incentives provided by equity-based compensation induce bank executives to make riskier business policy decisions, leading to excessive risk-taking in the banking industry. However, little attention is given to the board of directors, which is the common apex of the banking organizations and has the power to ratify and monitor important decisions initiated by the managers (Fama and Jensen (1983)). As financial intermediaries, banks are "special" in the sense that they play a major role in transferring funds from surplus spending units to deficit spending units, serve as a channel of monetary policy, administer the payment system and provide funding to favored sectors of the economy such as housing and agriculture. They have also been the

[13] Source: Federal Deposits Insurance Corporation failed banks database.

origins of many major shocks leading to financial crises, including the recent crisis of 2007-2009. Hence, safety of banks is essential to the financial stability and economic development of their home country as well as the rest of the world. Therefore, bank boards are under regulators' pressure to formulate safe and sound business policies in order to control and monitor managerial risk-taking behavior of their firms (Adams (2009); Adams and Mehran (2003)). This paper investigates the relevance of bank boards to risk-taking patterns of the BHCs. In particular, we examine the structure and effectiveness of bank boards in controlling risk-taking policy.

Risk control by the board of directors is arguably more important for banks than for nonfinancial firms because of high leverage, opacity and the need to satisfy stricter regulatory requirements. First, banks, whose primary claimholders are the depositors, are highly leveraged. Therefore, bank directors are expected to serve the interests of depositors and deposit insurers, that is, restricting excessive risk-taking (Macey and O'Hara (2003)). Second, opacity of banks makes it costly and difficult for depositors and regulators to monitor managerial risk-taking behavior. Therefore, the monitoring duty largely falls on bank boards (Levine (2004)). In general, bank boards constitute the first-line of defense against incumbent management (Weisbach (1988)) and board monitoring has a significant impact on bank risk-taking operations.

To examine the relationship between board structure of banks and risk management, we collect information on the risk management committee of the board of directors from banks' proxy statement (DEF14A) for the largest US bank holding companies (BHCs) over the 1999–2009 period. Several important findings are obtained. First, we find that the percentage of banks having a risk committee has been increasing steadily from 17% to 57% from 1999 to 2009, suggesting that more bank boards have included risk management as one of their primary responsibilities. Second, we find that banks with stronger boards in risk management, namely, a greater number of directors and more frequent meetings of risk committee, are associated with more diversified loan portfolios, higher percentage of loans in safe categories, and less mortgage-backed securities (MBS). Finally, we find that banks with stronger boards in risk management are associated with lower market risk, measured by β. The above results continue to hold after controlling for possible endogeneity problem with the dynamic panel GMM estimator developed by (Arellano and Bond (1991)). Overall, we find that banks with a stronger risk management boards have less risky business policies, and hence lower risk.

This study contributes to the existing research in the following ways. First, we show that in the recent decade a greater number of bank boards have established a committee dedicated to risk management, supporting the view that bank boards have expanded fiduciary duties beyond shareholders to include depositors (Macey and O'Hara (2003)). Second, we examine the impact of the board structure on risk management. The evidence supports the view that stronger risk committees established by bank boards can have a significant and positive impact on banks' safety and soundness. Finally, our finding that less than half of bank boards had risk committees before the recent financial crisis, suggests that weak internal risk management at the top organizational level of financial institutions may have contributed to the excessive risk-taking behavior that brought about the financial crisis. Moreover, although bank boards have taken a greater role in risk management after the crisis, more than 40% of banks do not have any risk committee, suggesting that the banking industry needs to further improve the internal risk management to enhance the stability.

The paper is organized as follows. Section 2 reviews the related literature and develops the hypothesis. Section 3 describes the sample data and variable construction. Section 4 presents the empirical results and Section 5 concludes.

3.2 Literature Review and Hypothesis Development

3.2.1 Board of Directors in Nonfinancial Firms

The existing research on the board of directors has focused on the protection of shareholders. As the ‘apex body’ of an organization’s internal governance system, the board plays an important role in monitoring and advising the firm management on behalf of shareholders (Fama and Jensen (1983)). Because the formal theory on the board of directors is quite limited, most of the existing research has focused on the impact of board size and independence on firm value (Hermalin and Weisbach (2003)). Jensen (1993) suggests that boards of smaller size are more effective because they have lower coordination costs and less free-riding problems. Yermack (1996) documents that board size and firm value have an inverse relationship on a sample of large U.S corporations. Regarding board independence, independent directors are believed to be more effective monitors as they have incentives to develop their reputations as experts in corporate oversight (Fama and Jensen (1983)). In this regard, Weisbach (1988) find that outsider-dominated boards are more likely to fire CEOs after poor firm performance. Brickley et al. (1994) document that, for firms with a larger fraction of outside directors, the market reaction to the adoption of poison pills is positive, suggesting that outside directors serve the interests of shareholders in corporate control contests. However, there is no noticeable relationship between percentage of outside directors on boards and firm value (Bhagat and Black (2002); Hermalin and Weisbach (1991)). Coles et al.(2008) further investigate the association between board structure and firm value by taking firm complexity and R&D intensity into account. They find that firm value increases with board size in complex firms because larger boards can bring more knowledge and expertise. They also find that R&D intensive firms benefit from firm-specific knowledge of inside directors. Overall, they argue that either small or large boards can be optimal.

3.2.2 Board of Directors in Banks and Hypothesis Development

Extant studies on bank boards have generally focused on the same measures of board structure and director characteristics as in nonfinancial firms, such as board size and director independence (Mishra and Nielsen (2000)). Adam and Mehran (2003) compare boards of BHCs to those of manufacturing firms. They document that bank boards are significantly larger with more outside directors and more committees than nonfinancial firms because BHCs are generally large and more complex. Contrary to the conventional wisdom that smaller boards are more effective in nonfinancial firms, Adam and Mehran (2005) find that larger bank boards are not associated with lower firm value measured by Tobin’s Q. On the other hand, Pathan (2009) finds that smaller and more independent bank boards are associated with greater risk taking, suggesting that smaller and more independent boards are more effective in monitoring managers in the interest of the shareholders.

However, applying the same “good governance” measures for bank boards as developed in nonfinancial firms may lead to misleading conclusions. For example, comparing the corporate governance of banks and nonfinancial firms before the 2007-

2009 financial crisis, Adams (2011) finds that bank boards generally appear to be better in terms of board independence, attendance and gender diversity. Bank directors are expected to hold a broader standard of care of duty than those in nonfinancial firms for the following reasons: importance of financial intermediation to the well-being of the overall economy, importance of bank safety to the stability of the financial system and the possibility of contagion, and the high leverage in the banking enterprise. First, banks play an important role in transmission of monetary policy, bank failures may create a contagion effect, leading to instability in the banking industry and harming the entire economy. Therefore, the safety and soundness of banks is one of primary concerns of regulators. Because business decision ratification and monitoring are delegated to board directors (Fama and Jensen (1983)) and regulators are concerned with the stability of the financial sector, bank boards are under regulatory pressure to ensure the safety and soundness of banks (Adams (2009)). Adams and Mehran (2003) provide examples of the regulatory expectations on bank boards for stability, including the quarterly review of the adequacy of allowance for loan loss reserve (Interagency Policy Statement on Loan and Lease Losses), the annual approval of bank risk management policies (Federal Reserve Board Trading Activities Manual), and the monthly review exposure reports (121 Report and New York State banking law). Second, the high debt-to-equity ratio and the existence of deposit insurance exacerbate the risk-shifting problem from shareholders to depositors and deposit insurers in banks because high leverage allows shareholders to capture most of the gains from the risky investment strategy while the downside risk of those risky projects is largely born by depositors and deposit insurers (Jensen and Meckling (1976)). In banks where depositors are the primary claimholders, Macey and O'Hara (2003) argue that bank directors owe fiduciary duties not only to shareholders but also to depositors. As a firm is a nexus of all explicit and implicit contracts, board directors are expected to be contracted to serve the interests of depositors and deposit insurers, that is, restricting excessive risk-taking. Indeed, Chen (2011) finds that forced bank CEO turnover is significantly and positively associated with banks' risk level while insignificantly correlated with poor stock performance, suggesting that bank directors are more concerned with "safety and soundness" than profitability. Overall, the board of directors of a banking firm is placed in a crucial role for ensuring the safety and soundness of the bank. As such, we propose the following hypothesis:

Hypothesis H_1: Stronger risk management by bank boards is associated with less risky business policies, and, hence, lower bank risk.

3.3 Data and Summary Statistics

3.3.1 Sample Collection

The sample period runs from 1999 to 2009. To be included in the sample, we require BHCs to file the Federal Reserve's Consolidated Financial Statements for Bank Holding Companies (FR Y9C report) and to have executive compensation data on Standard & Poor's Execucom. Thus, our sample includes the largest 84 U.S BHCs. We hand-collect the risk management committee information of board of directors from banks' proxy statement (DEF14A) in the SEC's EDGAR database. We identify the bank risk committee if the committee is delegated the role of risk management as one of its primary responsibilities as stated in the proxy statement. The risk committee is usually called "Risk Committee", "Risk Management Committee", or "Risk Oversight

Committee”. In some banks, risk management function is overseen by the Risk and Audit Committee, or the Risk and Finance Committee. The appendix provides selected key information of risk committees and their primary functions. For bank boards with a risk committee, we then collect the number of directors on the risk committee and the number of meetings in every fiscal year.

We collect financial data of BHCs from Y9C reports, including balance sheet, income statement, and other detailed supporting schedules such as off-balance sheet items. We obtain BHC stock price and return information from the Center for Research in Security Prices (CRSP). We obtain CEO compensation data using Execucomp. Execucomp database provides information on all aspects of executive compensation and covers the S&P 1500 plus companies. Our final sample contains 84 BHCs with 777 bank-year observations.

3.3.2 Sample Statistics and Variable Construction

Table 15 reports the descriptive statistics for the total assets and the assets composition of BHCs. The BHCs in our sample are the largest U.S. banking firms with the average (median) assets size of $102.99 (17.10) billion. Since the distribution of assets size is highly skewed in the sample, we use the natural logarithm of the assets to measure bank size. BHC assets include cash, loans, securities, trading assets, federal funds and reverse repurchase agreements, premises and intangibles. Loans represent 63.06% of total assets on average, which is the largest category of assets. Regarding the diversification of the loan portfolio, the Herfindahl-Hirschman index for loans (LoanHHI) has a mean of 0.46 with a standard deviation of 0.16. For the loan categories, commercial and industrial loans represent 4.01% of total assets on average, while the percentage of consumer loans in total assets is 5.93%. In our sample, the ratio of mortgage-backed securities to total assets has a mean of 12.53% with a standard deviation of 8.93%. BHCs have a relatively high leverage with the average capital ratio of 8.09%.

BHC total market risk, measured by the annualized standard deviation of daily stock returns for a given year, has a mean of 0.02 with a standard deviation of 0.02. The average systematic risk measured by beta from the CAPM is 1.09, whereas idiosyncratic risk has a mean of 0.02 with a standard deviation of 0.01. With regard to managerial compensation, the mean (median) delta value is \$455,240 (\$250,490), which suggests that for a one percent increase in stock price, the CEO stock and option holdings value increases by \$455,240 on average. The mean (median) vega is \$186,160 (\$89,390), suggesting that for one percent increase in standard deviation of the stock returns, CEO option holdings value increases by \$186,160 on average.

Table 15. Sample Statistics of Bank Assets, Risk Committee and CEO Compensation

Panel A. BHC assets, risk committee and CEO compensation

	N	Mean	Median	Standard Deviation	Min	25th percentile	75th percentile	Max
Total Assets (Billions)	777	102.99	17.10	284.62	1.27	6.57	54.36	2187.63
Cash (%)	777	4.74	3.30	5.07	1.17	2.51	4.57	37.24
Total loans (%)	777	63.06	66.89	14.62	7.86	56.92	72.58	92.46
Securities (%)	777	20.63	19.57	10.32	1.64	13.61	25.22	61.10
Federal funds (%)	581	2.07	0.46	3.64	0.00	0.02	2.19	19.49
TradingAssets(%)	777	1.70	0.06	4.54	0.00	0.00	1.08	32.80
CapitalRatio(%)	777	8.09	7.83	1.87	5.16	6.98	8.73	22.80
LoanHHI	777	0.46	0.46	0.16	0.02	0.36	0.56	0.98
LoanCI(%)	777	14.01	13.27	8.07	0.03	8.71	18.04	51.47
LoanCS(%)	777	5.93	4.85	5.40	0.02	2.14	8.67	54.49
MBS(%)	567	12.53	10.89	8.93	0.04	6.22	16.81	55.67
STD(StockReturn)	777	0.02	0.02	0.01	0.01	0.01	0.02	0.10
Beta(Market)	777	1.09	1.07	0.43	0.35	0.76	1.33	2.77
STD(Residuals)	777	0.02	0.01	0.01	0.01	0.01	0.02	0.08
NumRiskDir	231	5.76	5.00	3.52	2.00	4.00	8.00	9.00
NumRiskMeet	231	5.02	5.00	1.86	1.00	4.00	6.00	11.00
RiskCommittee	777	0.00	-0.59	1.00	-0.59	-0.59	0.94	2.53
Delta(1000s)	777	455.24	250.49	530.83	0.44	102.23	617.90	3549.30
Vega(1000s)	777	186.16	89.39	255.79	1.42	26.65	243.87	1425.91

Panel B. Risk committee in banks from 1999 to 2009

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
Banks without Risk Committee	70	70	69	66	58	51	44	34	32	30	22	546
Banks with Risk Committee	14	13	14	17	20	22	23	28	26	25	29	231
% of Banks with Risk Committee	17%	16%	17%	20%	26%	30%	34%	45%	45%	45%	57%	30%
Total Number of Banks	84	83	83	83	78	73	67	62	58	55	51	777

Table 15 Panel B reports the number of banks which do and do not have a risk committee from year 1999 to 2009. Figure 3 shows the number and percentage of banks having a risk committee. For banks with a risk committee, the average number of directors on risk committee is 5.76 and the average number of risk committee meetings is 5 times per year. Since 1999, the percentage of banks having a risk committee has been increasing from 17% to 57% steadily, suggesting that bank boards have been increasingly taking greater responsibility in the task of risk management. However, before 2007, less than half of the BHCs in the sample had established a risk committee, suggesting that weak internal risk management at the top of financial institutions may have failed to control the excessive risk-taking behavior that brought about the financial crisis.

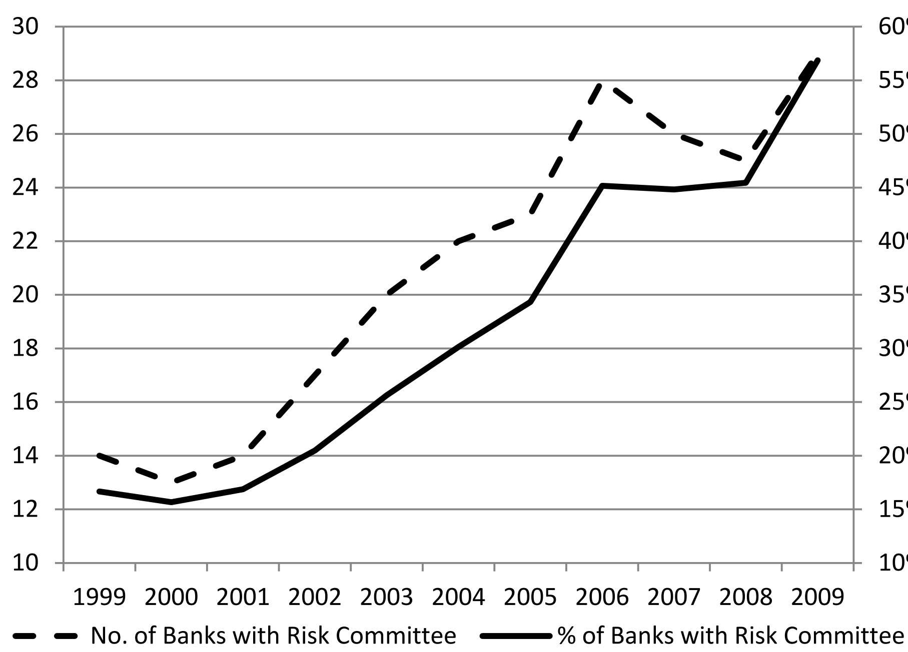

Figure 3. Risk Committee in Bank Holding Companies (1999-2009)

Table 16 reports the pair wise correlation for the key variables in the sample. We find a high and statistically significant correlation between the number of directors and the number of meetings of risk committee. The correlation coefficient between the two variables is 0.785 and significantly positive at less than the 0.001 level. To measure the risk management strength of bank boards, we construct a risk management factor, labeled *RiskCommittee*, by taking the factor score[14] from two variables of risk committee using the principal component method: the number of directors and the number of meetings. The advantage of using factor analysis is that we are able to combine the two highly correlated variables, the number of directors and the number of meetings, into one single factor.

[14] The mean of factor score across the sample is zero with the variance equal to one because the factor score is standardized during the factor analysis process.

Table 16. Correlations between Bank Assets, Risk and Risk Committee

	TotalAssets	LoanHHI	LoanCI	LoanCS	MBS	TradingAssets	NumRiskDir	NumRiskMeet	Delta	Vega	CapitalRatio
TotalAssets	1.000										
LoanHHI	-0.487	1.000									
	(0.000)										
LoanCI	-0.027	-0.205	1.000								
	(0.520)	(0.000)									
LoanCS	0.181	-0.132	-0.120	1.000							
	(0.000)	(0.001)	(0.004)								
MBS	-0.098	0.089	-0.189	-0.045	1.000						
	(0.018)	(0.032)	(0.000)	(0.285)							
TradingAssets	0.629	-0.370	-0.122	0.038	-0.079	1.000					
	(0.000)	(0.000)	(0.003)	(0.359)	(0.057)						
NumRiskDir	0.477	-0.269	0.145	-0.012	-0.148	0.194	1.000				
	(0.000)	(0.000)	(0.001)	(0.790)	(0.001)	(0.000)					
NumRiskMeet	0.440	-0.321	0.014	-0.007	-0.074	0.275	0.785	1.000			
	(0.000)	(0.000)	(0.759)	(0.878)	(0.095)	(0.000)	(0.000)				
Delta	0.510	-0.183	-0.173	0.195	0.057	0.329	0.246	0.198	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.167)	(0.000)	(0.000)	(0.000)			
Vega	0.693	-0.289	-0.134	0.304	-0.080	0.427	0.359	0.251	0.678	1.000	
	(0.000)	(0.000)	(0.002)	(0.000)	(0.059)	(0.000)	(0.000)	(0.000)	(0.000)		
CapitalRatio	-0.281	0.260	0.277	0.225	-0.166	-0.298	-0.037	-0.068	-0.098	-0.081	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.403)	(0.120)	(0.019)	(0.057)	

Note: P-values are reported in parentheses below each correlation estimate.

3.4 Empirical Results and Analysis

3.4.1 Risk Committee and Bank Business Policy

In this section, we examine whether risk committee matters in setting of the bank business policy. Our empirical model takes the following form:

$$BusinessPolicy_{i,t} = \beta_0 + \beta_1 \times TotalAssets_{i,t} + \beta_0 \times RiskCommittee_{i,t} + \beta_0 \times Vega_{i,t} + \beta_0 \times CapitalRatio_{i,t} + \mu_t + \epsilon_{i,t} \quad (1)$$

In the model, *TotalAssets* is the natural logarithm of total assets in BHC i. $RiskCommittee_i$ is the factor which measures the risk management strength of BHC *i*. $Vega_i$ denotes the CEO's wealth change for a 1% change in stock returns volatility of BHC *i*[15]. $CapitalRatio_i$ is the capital to assets ratio of BHC *i*.

We focus on four bank business policy variables: *LoanHHI*, *LoanCI*, *LoanConsumer*, and *MBS*. First, *LoanHHI* is the Herfindahl-Hirschman Index (HHI) of bank loans, which is a proxy for bank asset concentration (diversification). Traditional banking includes making loans to different economic sectors such as commercial and industrial businesses, real estate, agriculture, financial institutions, individuals, and others. *LoanHHI* is obtained by $\sum(Loan_k/TotalLoans)^2$, where $Loan_k$ is the amount of loans in category *k*. If a BHC makes loans concentrated in limited categories, it is more likely to be affected by specific business factors. Thus, higher HHI of loans is positively

[15] As reported in Table 16, delta and vega are highly correlated as the correlation coefficient is 0.678 and significant at less than 1% level. The high correlation between delta and vega invalidate the joint inclusion of both variables in a single regression model.

related to bank risk. If risk committee has a positive effect on managerial decisions on business choices, then, it is expected that stronger risk management of bank boards is associated with less concentration in loans, that is, *RiskCommitee* is negatively related to *LoanHHI*.

Our next business policy variables are *LoanCI* and *LoanCS*. The variable *LoanCI* is the percentage of commercial and industrial loans in the total assets, while *LoanCS* is the percentage of consumer loans in the total assets. Prior studies suggest that commercial and industrial loans are the riskiest among all categories of loans while consumer loans are relatively safe (DeYoung, Peng and Yan (forthcoming); Gorton and Rosen (1995)). If bank directors of risk committee understand the riskiness of different loan categories, it is expected that stronger risk monitoring by risk committee is associated with less risky loans but more safe loans, that is, *RiskCommittee* is positively related to *LoanCS* but negatively related to *LoanCI*.

MBS is the ratio of the nominal value of mortgage-backed securities (MBS) held to maturity relative to total assets. Mortgage-backed securities are debt obligations whose cash flows are backed by the principal and interest payments of pools of mortgage loans, most commonly on residential property. We are interested in bank risk exposure to mortgage backed securities because these types of assets are complex and difficult to value, and they are considered as the underlying source of the 2007-2009 financial crisis (Demyanyk and Van Hemert (2008); Ferrell, Bethel and Hu (2008); Purnanandam (2011)). We expect that stronger risk management of bank board is associated with less holding of mortgage-backed securities.

Table 17 presents the parameter estimates of Equation (1). The key parameter of interest is β_2 which captures the effectiveness of risk committee on bank business policies including loans in different categories, loans concentration, and bank operations in non-traditional businesses. In Column (1), *LoanHHI* is the dependent variable in the regression equation, in which we examine whether banks with a stronger risk management board have more diversified loans across different loan categories. The coefficient of *RiskCommitee* carries a negative sign and it is statistically significant at the 1% level. In terms of economic significance, the coefficient of -0.023 on *RiskCommitee* indicates that a one standard deviation increase in *RiskCommitee* is associated with a decrease of 0.023 in loan concentration, which is equivalent to a 0.14 (0.023/0.16) standard deviation decrease in loan concentration. The finding that loan concentration decreases as risk management of bank boards becomes stronger is consistent with the hypothesis that when bank boards increase monitoring risk taking, the portfolio of loans made by banks become more diversified.

In Column (2) and (3) of Table 17, *LoanCS* and *LoanCI* are the dependent variables in the regression equation, in which we examine whether banks with a stronger risk management board have more loans in safer categories while less loans in riskier categories. The coefficient of *RiskCommitee* in *LoanCS* model is positive and statistically significant at the 1% level while the coefficient of *RiskCommitee* in *LoanCI* model is negative and statistically significant at the 1% level. The findings are consistent with our conjecture that banks with a stronger risk management board have a higher percentage of loans in safer categories while banks with a relatively weak risk management board have more loans in riskier categories. In terms of economic significance, the coefficient of

0.012 on *RiskCommitee* indicates that a one standard deviation increase in *RiskCommitee* is associated with an increase of 0.012 in the percentage of consumer loans, which is equivalent to a 0.22 (0.012/0.054) standard deviation increase in the percentage of consumer loans. Regarding commercial and industrial loans, the coefficient of -0.006 on *RiskCommitee* indicates that a one standard deviation increase in *RiskCommitee* is associated with a decrease of 0.006 in the percentage of commercial and industrial loans, which is equivalent to a 0.07 (0.006/0.0807) standard deviation decrease in the percentage of commercial and industrial loans. The finding that consumer loans increases with greater risk management of bank boards while commercial and industrial loans decreases is consistent with the hypothesis that when bank boards take a greater role in risk control, banks make more of the safer loans but less of the riskier loans.

In Column (4) of Table 17, *MBS* is the dependent variable in the regression equation, in which we investigate whether risk management activities of bank boards affect the holdings of mortgage-backed securities. The coefficient of *RiskCommitee* is negative and statistically significant at the 5% level. In terms of economic significance, the coefficient of -0.004 on *RiskCommitee* indicates that a one standard deviation increase in *RiskCommitee* is associated with a decrease of 0.004 in the ratio of mortgage-backed securities to total assets. The finding that mortgage-backed securities decreases with increased risk management of bank boards is consistent with the hypothesis that when bank boards have a stronger risk control, banks hold less mortgage-backed securities, which are inherently complex to monitor their risk (Simkovic (2011)).

Table 17. Risk Committee and Bank Business Policy

	(1) LoanHHI	(2) LoanCS	(3) LoanCI	(4) MBS
Assets(log)	-0.044***	0.012***	0.005**	-0.005**
	(0.000)	(0.000)	(0.035)	(0.011)
RiskCommittee	-0.023***	0.012***	-0.006***	-0.004**
	(0.001)	(0.001)	(0.010)	(0.014)
Vega	0.008*	-0.058***	0.060**	0.016*
	(0.069)	(0.005)	(0.016)	(0.050)
Capital Ratio	0.012***	0.015***	0.009**	-0.005***
	(0.005)	(0.000)	(0.014)	(0.000)
Intercept	1.134***	-0.166**	-0.118**	0.141***
	(0.000)	(0.016)	(0.036)	(0.000)
Year Dummy	Yes	Yes	Yes	Yes
N	552	552	552	552
R-sq	0.31	0.17	0.21	0.09
adj. R-sq	0.29	0.15	0.19	0.07

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

3.4.2 Endogeneity of Risk Management

The finding that banks with a stronger risk management board hold a more diversified portfolio of loans, a greater level of safer loans and less mortgage-backed securities is consistent with the hypothesis that increased risk monitoring by bank boards is associated with safer business policy. However, the panel regression model does not reveal the direction of the underlying causal relationship. It is possible that the board risk management structure and activity itself is an endogenously determined variable whose characteristics are affected by the level of bank risk, in which case our panel regression model would be subject to endogeneity problems. For example, it is possible that banks exposed to a greater level of risk choose to increase risk control by board of directors, such as forming a risk committee or increasing the number of directors serving on the risk committee. Because of the difficulty in finding any exogenous instrument to identify the impact of risk management on risk business policy, we use a dynamic panel GMM estimator developed by Arellano and Bond (1991). The GMM model enables us to use lagged risk policy measures and other bank characteristics as exogenous instruments for identifying the relationship between board risk management and bank risk policies. Specifically, the GMM model is described as follows:

$$\begin{aligned} BusinessPolicy_{i,t} = \beta_0 + \alpha_1 \times BusinessPolicy_{i,t-1} + \alpha_2 \times BusinessPolicy_{i,t-2} \\ \beta_1 \times TotalAssets_{i,t} + \beta_0 \times RiskCommittee_{i,t} \\ +\beta_0 \times Vega_{i,t} + \beta_0 \times CapitalRatio_{i,t} + \mu_t + \epsilon_{i,t} \end{aligned} \quad (2)$$

Table 18 presents the parameter estimates of the GMM model. The dependent variables in Columns (1) – (4) are *LoanHHI*, *LoanCS*, *LoanCI* and *MBS*, respectively. The coefficient of *RiskCommittee* in *LoanHHI*, *LoanCI* and *MBS* equations continue to be negative and significant, while the coefficient of *RiskCommittee* in the *LoanCS* equation remains positive and significant. In each column, we present the results of the Hansen test for the validity of instruments employed in the model (Hansen (1982)). The Hansen test yields a statistic which is distributed as χ^2 under the null hypothesis of the validity of our instruments. The Hansen p-values in Columns (1) to (4) are greater than 0.254, indicating that we cannot reject the null hypothesis that our instruments are valid. Overall, the results in Table 18 indicate that BHCs with a stronger risk committees hold loan portfolios which are more diversified, contain a greater level of safer loans and a lesser level of mortgage-backed securities, even after controlling for the dynamic endogeneity between business policy and internal risk controls.

Among the control variables, total assets, used as the proxy for bank size, is positively related to *LoanHHI* and the estimates are statistically significant at the ten percent level. This suggests that larger banks have more diversified loans portfolio, because it is easier for large banks to diversify larger portfolios. The coefficient of *vega* in *LoanHHI*, *LoanCI* and *MBS* equations is positive and significant, while the coefficient of *vega* in *LoanCS* equation is negative and significant. The results are consistent with prior studies (Bai and Elyasiani (2012); DeYoung, Spong and Sullivan (2001)), which suggest that as CEO's personal wealth sensitivity to stock risk increases, the CEO has stronger incentives to take on more risks at the expense of depositors and deposit insurers, leading to riskier business policies. The capital-to-assets ratio serves as the measure of capital adequacy. A greater capital ratio increases loan concentration and commercial loans as both estimates are statistically significant at the five percent level. The reason that the capital ratio is positively related to the *LoanHHI* may be that banks feel confident to increase their loans in a particular category and, thereby their loan concentration, when they have more capital available. The explanation for the positive association between the capital ratio and commercial loans may be that banks become more daring in pursuing risky investments with adequate capital.

Table 18. Risk Committee and Bank Business Policy (GMM)

	Y			
	(1)	(2)	(3)	(4)
	LoanHHI	LoanCS	LoanCI	MBS/Assets
Y(t-1)	0.213***	0.299***	0.201**	0.277***
	(0.003)	(0.000)	(0.043)	(0.004)
Y(t-2)	-0.151	0.016	-0.123	-0.234***
	(0.243)	(0.889)	(0.391)	(0.000)
Assets(log)	0.050*	-0.012	-0.001	0.012
	(0.058)	(0.331)	(0.939)	(0.528)
RiskCommittee	-0.007**	0.006**	-0.002*	-0.003*
	(0.045)	(0.041)	(0.081)	(0.088)
Vega	0.009*	-0.011**	0.005*	0.004**
	(0.082)	(0.043)	(0.062)	(0.025)
Capital Ratio	0.004**	0.000	0.003**	-0.001
	(0.032)	(0.548)	(0.040)	(0.472)
N	302	302	302	302
Hansen χ^2	56.36	53.43	48.85	57.27
Hansen *p*-value	0.281	0.381	0.559	0.254

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

3.4.3 Risk Committee and Bank Risk

In this section, we examine the relationship between the board structure and bank overall risk using market-based risk measures. We estimate three market-based risk measures for each year using weekly data from the relevant year obtained from the Center for Research in Security Prices (CRSP). The total risk is the standard deviation of the stock returns. The systematic risk is the beta obtained from the CAPM, and the idiosyncratic risk is the standard deviation of the residuals obtained from the CAPM.

Table 19 presents regression results for the GMM model based on market measures of risk. The coefficient estimate on *RiskCommittee* is negative and statistically significant at the five percent level for the market risk (beta) while the coefficients are negative but insignificant for the total and idiosyncratic risks. These results are consistent with our prior findings on the impact of board structure on bank business choices, suggesting that the stronger risk committee in bank board reduces a bank's systematic risk. The coefficient estimates on the vega is positive and statistically significant at the five percent level or better for all three risk measures, suggesting that the CEO's compensation sensitivity to risk increases a bank's total, systematic, and idiosyncratic risks. The findings on the CEO compensation are consistent with DeYoung et al. (forthcoming) and Bai and Elyasiani (2012) who find that greater vega is associated with higher bank risk.

Table 19. Risk Committee and Bank Risk

	Risk		
	Std(StockReturn)	Beta(Market)	Std(residual)
Risk(t-1)	0.221*	0.026	-0.025
	(0.086)	(0.730)	(0.883)
Risk(t-2)	0.130	-0.116	0.019
	(0.411)	(0.236)	(0.923)
Assets(log)	-0.012**	-0.089	-0.010**
	(0.034)	(0.520)	(0.041)
RiskCommittee	-0.002	-0.114**	-0.002
	(0.317)	(0.033)	(0.117)
Vega	0.039***	1.506***	0.017**
	(0.001)	(0.000)	(0.042)
Capital Ratio	-0.001	-0.037*	0.000
	(0.639)	(0.076)	(0.999)
N	302	302	302
Hansen Chi2	52.58	53.54	56.40
Hansen p-value	0.413	0.377	0.280

Note: Standard errors are reported in parentheses below each coefficient estimate, and *, **, and *** indicates statistical significance at the 10%, 5% and 1% level, respectively.

3.5 Conclusion

This paper analyzes the association between board structure and risk of banks. First, we document that bank boards have gradually taken a greater role in risk management as the percentage of banks having risk committee has been increasing steadily during the 1999-2009 period. The finding that bank boards have a committee dedicated to risk management provides evidence that bank boards have expanded fiduciary duties beyond shareholders to include depositors because depositors are the primary claimholders of banks (Macey and O'Hara (2003)).

Second, we find that banks with a greater number of risk committee directors and more frequent meetings are associated with loan portfolios which are more diversified, contain a higher percentage of loans in safe categories, and hold less mortgage-backed securities. Hence, they are associated with a lower systematic risk. These results continue to hold after we account for possible endogeneity problem using the dynamic panel GMM estimator. Overall, a stronger risk committee of bank boards has a greater power in monitoring risky policy initiation and implementation of bank managers. Therefore, a stronger risk management of bank boards has a positive and significant impact on banks' safety and soundness.

Finally, we document that less than half of bank boards had risk committees before 2007, suggesting that the weak risk management within banks during that period may have contributed to excessive risk-taking in the banking industry that led to the recent financial crisis. Even after the crisis, the percentage of banks with risk committees is less than 60%. As opaque assets in banks are unique and costly for outside stakeholders and regulators to monitor, depositors and bank supervisors could enhance the stability of banks by improving the effectiveness of internal risk control at bank boards, which exercise the top-level decision control rights and directly monitor managers.

REFERENCES CITED

Adams, Renee B., 2009, Governance of banking institutions *Working paper*.

Adams, Renée B., 2011, Governance and the financial crisis, *Working paper*.

Adams, Renee B., Heitor Almeida, and Daniel Ferreira, 2005, Powerful CEOs and their impact on corporate performance, *Review of Financial Studies* 18, 1403-1432.

Adams, Renee B., and Hamid Mehran, 2003, Is corporate governance different for bank holding companies?, *Economic Policy Review* 9, 123-142.

Adams, Renée B., and Hamid Mehran, 2005, Corporate performance, board structure and its determinants in the banking industry, *Working paper*.

Aggarwal, Rajesh K., and Andrew A. Samwick, 2003, Performance incentives within firms: The effect of managerial responsibility, *Journal of Finance* 58, 1613-1650.

Agrawal, Anup, and Gershon N. Mandelker, 1987, Managerial incentives and corporate investment and financing decisions, *Journal of Finance* 42, 823-837.

Altunbas, Yener, Lynne Evans, and Philip Molyneux, 2001, Bank ownership and efficiency, *Journal of Money, Credit and Banking* 33, 926-954.

Amihud, Yakov, and Baruch Lev, 1981, Risk reduction as a managerial motive for conglomerate mergers, *Bell Journal of Economics* 12, 605-617.

Ang, James, Beni Lauterbach, and Ben Schreiber, 2002, Pay at the executive suite: How do U.S. Banks compensate their top management teams?, *Journal of Banking and Finance* 26, 1143-1163.

Angrist, Joshua D., and Alan B. Krueger, 2001, Instrumental variables and the search for identification: From supply and demand to natural experiments, *Journal of Economic Perspectives* 15, 69-85.

Arellano, Manuel, and Stephen Bond, 1991, Some tests of specification for panel data: Monte carlo evidence and an application to employment equations, *The Review of Economic Studies* 58, 277-297.

Bai, Gang, and Elyas Elyasiani, 2012, Bank stability and managerial compensation, *Working paper*.

Baker, George P., 1992, Incentive contracts and performance measurement, *Journal of Political Economy* 100, 598-614.

Baker, George P., and Brian J. Hall, 2004, CEO incentives and firm size, *Journal of Labor Economics* 22, 767-798.

Barro, Jason R., and Robert J. Barro, 1990, Pay, performance, and turnover of bank CEOs, *Journal of Labor Economics* 8, 448-481.

Bebchuk, Lucian A., and Holger Spamann, 2010, Regulating bankers' pay, *Georgetown Law Journal* 98, 247-287.

Bebchuk, Lucian Arye, and Jesse M. Fried, 2003, Executive compensation as an agency problem, *Journal of Economic Perspectives* 17, 71-92.

Bebchuk, Lucian, Martijn Cremers, and Urs C. Peyer, 2007, CEO centrality, *National Bureau of Economic Research working paper, No. 13701*.

Berger, Allen N., Seth D. Bonime, Daniel M. Covitz, and Diana Hancock, 2000, Why are bank profits so persistent? The roles of product market competition, informational opacity, and regional/macroeconomic shocks, *Journal of Banking and Finance* 24, 1203-1235.

Berger, Philip G., Eli Ofek, and David L. Yermack, 1997, Managerial entrenchment and capital structure decisions, *Journal of Finance* 52, 1411-1438.

Berle, Adolf A., and Gardner C. Means, 1932. *The modern corporation and private property* (Transaction Publishers).

Bhagat, Sanjai, and Bernard S. Black, 2002, The non-correlation between board independence and long-term firm performance, *Journal of Corporation Law* 27, 231-273.

Black, Fischer, and Myron Scholes, 1973, The pricing of options and corporate liabilities, *Journal of Political Economy* 81, 637-654.

Brennan, Michael J., and Avanidhar Subrahmanyam, 1995, Investment analysis and price formation in securities markets, *Journal of Financial Economics* 38, 361-381.

Brewer III, Elijah , William C. Hunter, and William E. Jackson III, 2003, Deregulation and the relationship between bank CEO compensation and risk taking, *FRB of Chicago Working Paper* No. 2003-32.

Brickley, James A., Jeffrey L. Coles, and Rory L. Terry, 1994, Outside directors and the adoption of poison pills, *Journal of Financial Economics* 35, 371-390.

Brown, Keith C., W. V. Harlow, and Laura T. Starks, 1996, Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry, *Journal of Finance* 51, 85-110.

Chan, William, 1996, External recruitment versus internal promotion, *Journal of Labor Economics* 14, 555-570.

Chen, Carl R., Thomas L. Steiner, and Ann Marie Whyte, 2006, Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry, *Journal of Banking and Finance* 30, 915-945.

Chen, Zhongdong, 2011, Board structure, CEO turnover, and bank performance, *Working paper*.

Coles, Jeffrey L., Naveen D. Daniel, and Lalitha Naveen, 2006, Managerial incentives and risk-taking, *Journal of Financial Economics* 79, 431-468.

Coles, Jeffrey L., Naveen D. Daniel, and Lalitha Naveen, 2008, Boards: Does one size fit all, *Journal of Financial Economics* 87, 329-356.

Core, John, and Wayne Guay, 1999, The use of equity grants to manage optimal equity incentive levels, *Journal of Accounting and Economics* 28, 151-184.

Core, John, and Wayne Guay, 2002, Estimating the value of employee stock option portfolios and their sensitivities to price and volatility, *Journal of Accounting Research* 40, 613-630.

Crawford, Anthony J, John R Ezzell, and James A Miles, 1995, Bank CEO pay-performance relations and the effects of deregulation, *Journal of Business* 68, 231-256.

DeFusco, Richard A., Robert R. Johnson, and Thomas S. Zorn, 1990, The effect of executive stock option plans on stockholders and bondholders, *Journal of Finance* 45, 617-627.

Demsetz, Rebecca S., and Philip E. Strahan, 1997, Diversification, size, and risk at bank holding companies, *Journal of Money, Credit and Banking* 29, 300-313.

Demyanyk, Yuliya, and Otto Van Hemert, 2008, Understanding the subprime mortgage crisis, *working paper*.

Deng, Saiying, Elyas Elyasiani, and Connie X. Mao, 2007, Diversification and the cost of debt of bank holding companies, *Journal of Banking and Finance* 31, 2453-2473.

DeYoung, Robert, Emma Y. Peng, and Meng Yan, forthcoming, Executive compensation and business policy choices at U.S. Commercial banks, *Journal of Financial and Quantitative Analysis*.

DeYoung, Robert, Kenneth Spong, and Richard J. Sullivan, 2001, Who's minding the store? Motivating and monitoring hired managers at small, closely held commercial banks, *Journal of Banking and Finance* 25, 1209-1243.

Diamond, Douglas W., 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies* 51, 393--414.

Ehrenberg, Ronald G., and Michael L. Bognanno, 1990, Do tournaments have incentive effects?, *Journal of Political Economy* 98, 1307-1324.

Esty, Benjamin C., and William L. Megginson, 2003, Creditor rights, enforcement, and debt ownership structure: Evidence from the global syndicated loan market, *Journal of Financial and Quantitative Analysis* 38, 37-59.

Fama, Eugene, and Michael C. Jensen, 1983, Separation of ownership and control, *Journal of Law and Economics* 26, 301-325.

Ferrell, Allen, Jennifer Bethel, and Gang Hu, 2008, Legal issues in the subprime lending market, *Working paper*.

Fields, L. Paige, and Donald R. Fraser, 1999, On the compensation implications of commercial bank entry into investment banking, *Journal of Banking and Finance* 23, 1261-1276.

Flannery, Mark J., Simon H. Kwan, and M. Nimalendran, 2004, Market evidence on the opaqueness of banking firms' assets, *Journal of Financial Economics* 71, 419-460.

Friedman, Jeffrey, 2010. *What caused the financial crisis* (University of Pennsylvania Press).

Gibbons, Robert, and Kevin J. Murphy, 1992, Optimal incentive contracts in the presence of career concerns: Theory and evidence, *Journal of Political Economy* 100, 468-505.

Gorton, Gary, and Richard Rosen, 1995, Corporate control, portfolio choice, and the decline of banking, *Journal of Finance* 50, 1377-1420.

Guay, Wayne R., 1999, The sensitivity of CEO wealth to equity risk: An analysis of the magnitude and determinants, *Journal of Financial Economics* 53, 43-71.

Hagendorff, Jens, and Francesco Vallascas, 2011, CEO pay incentives and risk-taking: Evidence from bank acquisitions, *Journal of Corporate Finance* 17, 1078-1095.

Hall, Brian J., and Jeffrey B. Liebman, 1998, Are CEOs really paid like bureaucrats?, *Quarterly Journal of Economics* 113, 653-691.

Hall, Brian J., and Kevin J. Murphy, 2002, Stock options for undiversified executives, *Journal of Accounting and Economics* 33, 3-42.

Hansen, Lars Peter, 1982, Large sample properties of generalized method of moments estimators, *Econometrica* 50, 1029-1054.

Hassan, M. Kabir, Gordon V. Karels, and Manfred O. Peterson, 1994, Deposit insurance, market discipline and off-balance sheet banking risk of large U.S. Commercial banks, *Journal of Banking and Finance* 18, 575-593.

Hermalin, Benjamin E., and Michael S. Weisbach, 1991, The effects of board composition and direct incentives on firm performance, *Financial Management* 20, 101-112.

Hermalin, Benjamin E., and Michael S. Weisbach, 2003, Boards of directors as an endogenously determined institution: A survey of the economic literature, *Economic Policy Review* 9, 7-26.

Holmstrom, Bengt, 1979, Moral hazard and observability, *Bell Journal of Economics* 10, 74-91.

Houston, Joel F., and Christopher James, 1995, CEO compensation and bank risk: Is compensation in banking structured to promote risk taking?, *Journal of Monetary Economics* 36, 405-431.

Hubbard, R. Glenn, and Darius Palia, 1995, Executive pay and performance evidence from the U.S. Banking industry, *Journal of Financial Economics* 39, 105-130.

Hvide, Hans K., 2002, Tournament rewards and risk taking, *Journal of Labor Economics* 20, 877-898.

Jensen, Michael C., 1993, The modern industrial revolution, exit, and the failure of internal control systems, *Journal of Finance* 48, 831-880.

Jensen, Michael C., and William Meckling, 1976, Theory of the firm: Managerial behavior, agency costs and ownership structure, *Journal of Financial Economics* 3, 305-360.

Jensen, Michael C., and Kevin J. Murphy, 1990, CEO incentives - it's not how much you pay, but how, *Journal of Applied Corporate Finance* 3, 36-49.

Jensen, Michael C., and Kevin J. Murphy, 1990, Performance pay and top-management incentives, *Journal of Political Economy* 98, 225-264.

John, Kose, and Yiming Qian, 2003, Incentive features in CEO compensation in the banking industry, *Economic Policy Review* 9, 109-121.

John, Kose, Anthony Saunders, and Lemma W Senbet, 2000, A theory of bank regulation and management compensation, *Review of Financial Studies* 13, 95-125.

John, Teresa A., and Kose John, 1993, Top-management compensation and capital structure, *Journal of Finance* 48, 949-974.

Keeley, Michael C., 1990, Deposit insurance, risk, and market power in banking, *American Economic Review* 80, 1183-1200.

Kishan, Ruby P., and Timothy P. Opiela, 2000, Bank size, bank capital, and the bank lending channel, *Journal of Money, Credit and Banking* 32, 121-141.

Knopf, John D., Jouahn Nam, and John H. Thornton, Jr., 2002, The volatility and price sensitivities of managerial stock option portfolios and corporate hedging, *Journal of Finance* 57, 801-813.

Krishnaswami, Sudha, and Venkat Subramaniam, 1999, Information asymmetry, valuation, and the corporate spin-off decision, *Journal of Financial Economics* 53, 73-112.

Laeven, Luc, and Ross Levine, 2009, Bank governance, regulation and risk taking, *Journal of Financial Economics* 93, 259-275.

Lambert, Richard A., David F. Larcker, and Robert E. Verrecchia, 1991, Portfolio considerations in valuing executive compensation, *Journal of Accounting Research* 29, 129-149.

Lazear, Edward P., 1989, Pay equality and industrial politics, *Journal of Political Economy* 97, 561-580.

Lazear, Edward P., and Sherwin Rosen, 1981, Rank-order tournaments as optimum labor contracts, *Journal of Political Economy* 89, 841-864.

Levine, Ross, 2004, The corporate governance of banks: A concise discussion of concepts and evidence, *World Bank Policy Research Working Paper*.

Macey, Jonathan R., and Maureen O'Hara, 2003, The corporate governance of banks, *Economic Policy Review* 9, 91-107.

Main, Brian G. M., Charles A. O'Reilly III, and Graef S. Crystal, 1988, CEO compensation as tournament and social comparison: A tale of two theories, *Administrative Science Quarterly* 33, 257-274.

Merton, Robert C., 1973, Theory of rational option pricing, *Bell Journal of Economics and Management Science* 4, 141-183.

Milgrom, Paul, and John Roberts, 1988, An economic approach to influence activities in organizations, *American Journal of Sociology* 94, S154-S179.

Mishra, Chandra S., and James F. Nielsen, 2000, Board independence and compensation policies in large bank holding companies, *Financial Management* 29, 51-69.

Morck, Randall, Andrei Shleifer, and Robert W. Vishny, 1989, Alternative mechanisms for corporate control, *American Economic Review* 79, 842-852.

Morgan, Donald P., 2002, Rating banks: Risk and uncertainty in an opaque industry, *American Economic Review* 92, 874-888.

Myers, Stewart C., and Raghuram G. Rajan, 1998, The paradox of liquidity, *Quarterly Journal of Economics* 113, 733-771.

O'Hara, Maureen, and Wayne Shaw, 1990, Deposit insurance and wealth effects: The value of being "Too big to fail", *The Journal of Finance* 45, 1587-1600.

Palia, Darius, 2001, The endogeneity of managerial compensation in firm valuation: A solution, *Review of Financial Studies* 14, 735-764.

Parrino, R., A. M. Poteshman, and M. S. Weisbach, 2005, Measuring investment distortions when risk-averse managers decide whether to undertake risky projects, *Financial Management* 34, 21-60.

Pathan, Shams, 2009, Strong boards, CEO power and bank risk-taking, *Journal of Banking and Finance* 33, 1340-1350.

Penas, María Fabiana, and Haluk Unal, 2004, Gains in bank mergers: Evidence from the bond markets, *Journal of Financial Economics* 74, 149-179.

Purnanandam, Amiyatosh, 2011, Originate-to-distribute model and the subprime mortgage crisis, *Review of Financial Studies* 24, 1881-1915.

Rajgopal, Shivaram, and Terry Shevlin, 2002, Empirical evidence on the relation between stock option compensation and risk taking, *Journal of Accounting and Economics* 33, 145-171.

Robb, Sean W., 1998, The effect of analysts' forecasts on earnings management in financial institutions, *Journal of Financial Research* 21, 315-332.

Romer, Christina D., and David H. Romer, 1990, New evidence on the monetary transmission mechanism, *Brookings Papers on Economic Activity* 21, 149-214.

Rosen, Sherwin, 1992, Contracts and the market for executives, in Lars Werin, and Hans Wijkander, eds.: *Contract economics* (Blackwell, Oxford).

Saunders, Anthony, and Marcia Cornett, 2010. *Financial institutions management: A risk management approach* (McGraw-Hill/Irwin).

Saunders, Anthony, Elizabeth Strock, and Nickolaos G. Travlos, 1990, Ownership structure, deregulation, and bank risk taking, *Journal of Finance* 45, 643-654.

Sharpe, Steven A., 1990, Asymmetric information, bank lending and implicit contracts: A stylized model of customer relationships, *Journal of Finance* 45, 1069-1087.

Simkovic, Michael, 2011, Competition and crisis in mortgage securitization, *Working paper*.

Smith, Clifford W., Jr., and Ross L. Watts, 1992, The investment opportunity set and corporate financing, dividend, and compensation policies, *Journal of Financial Economics* 32, 263-292.

Smith, Clifford W., and Rene M. Stulz, 1985, The determinants of firms' hedging policies, *Journal of Financial and Quantitative Analysis* 20, 391-405.

Stiroh, K.J., 2004, Diversification in banking: Is noninterest income the answer?, *Journal of Money, Credit and Banking* 36, 853-883.

Stiroh, Kevin J., 2006, New evidence on the determinants of bank risk, *Journal of Financial Services Research* 30, 237-263.

Weisbach, Michael S, 1988, Outside directors and CEO turnover, *Journal of Financial Economics* 20, 431-460.

Yermack, David, 1995, Do corporations award CEO stock options effectively?, *Journal of Financial Economics* 39, 237-269.

Yermack, David, 1996, Higher market valuation of companies with a small board of directors, *Journal of Financial Economics* 40, 185-211.

APPENDICES

APPENDIX A

CEO PAY-PERFORMANCE SENSITIVITY – DELTA

Delta is defined as the dollar value change of the executive's holdings of stocks and stock options for one percentage point change in stock price. The delta calculation follows (Guay (1999)) and (Core and Guay (2002)) approach.

We calculate the delta of the manager's portfolio of stocks and options by adding the delta of restricted stock and shares held by the CEO to the delta of his options portfolio.

Delta of manager's portfolio of stock and options:

$Delta_{CEO} = Delta_{options} + Delta_{stocks}$,

in which, $Delta_{stocks} = 0.01 \times Price \times Shares$, *Price* is the company share price at year *t*, *Shares* is the number of shares held by the CEO *i*.

The general formula of Delta for options (the sensitivity with respect to 1% stock price change) is:

$Delta_{options} = e^{-d \times T} \times N(Z) \times \frac{Price_{stock}}{100}$, in which,

$$Z = \frac{[\ln(S/X) + (r - d + \sigma^2/2) \times T]}{\sigma\sqrt{T}}$$

N = the cumulative probability function for the nominal distribution,
S = stock price
X = exercise price
r = natural log of risk-free interest rate = ln(1+r)
σ = expected stock return volatility over the life of the option
T = time to maturity of the option in years
d = natural log of dividend yield over the life of the option = ln(1+d)

Due to data availability, CEO's option portfolio on and before 2006 is divided into three groups: those newly granted in current year, those granted in previous years but not yet exercisable, and those exercisable. For new options, variables in the Black-Scholes formula are taken from the Execucomp database. For unexercised options, exercise prices and time-to-maturity are estimated. CEO's option portfolio on and after 2007 is divided into two groups: those unexercised exercisable and those unexercised exercisable options.

APPENDIX B

DESCRIPTION OF RISK COMMITTEE OF SELECTED BANK HOLDING COMPANIES

We examined proxy statements (Form DEF14A) for the largest bank holding companies (BHCs) from 2000 to 2010. The comments below are excerpts from the 2010 proxy statements for 10 BHCs. Proxy statements were obtained from EGAR/SEC.

Bank of America Corporation

Enterprise Risk Committee. The Enterprise Risk Committee currently consists of five directors, all of whom are independent. From its formation in October 2009 through the end of the year, the Enterprise Committee held four meetings. Duties of the Enterprise Risk Committee include:

- exercising oversight of senior management's identification of the material risks facing our company and, except as allocated by the Board to another committee, senior management's planning for, and management of, our company's material risks, including market risk, interest rate risk, liquidity risk and reputational risk;
- overseeing senior management's establishment of policies and guidelines, to be adopted by the Board, articulating our company's risk tolerances as to material categories of risk, the performance and functioning of our company's overall risk management function, as established by management, and senior management's establishment of appropriate systems (including policies, procedures, management committees and stress testing) that support control of market risk, interest rate risk and liquidity risk;

- reviewing management’s strategies, policies and procedures for managing market risk, interest rate risk, liquidity risk and reputational risk, and receiving and reviewing reports from senior management (including the Chief Risk Officer and appropriate management committees) regarding compliance with applicable risk related policies, procedures and tolerances, and reviewing our company’s performance relative to these policies, procedures and tolerances; and
- overseeing management’s activities with respect to capital management and liquidity planning, including approval of management’s plans with respect to liquidity sources, dividends, the issuance, repurchase or redemption of equity or other securities and issuance and repayment of our company’s debt.

The Bank of New York Mellon Corporation

Risk Committee. The Risk Committee meets as often as it deems necessary to perform its responsibilities. In 2009, the committee held six meetings.

As further discussed under “The Role of the Board in Risk Oversight” below, the committee is responsible for reviewing significant financial and other risk exposures and the steps management has taken to monitor, control and report such exposures, including, without limitation, credit, market, fiduciary, liquidity, reputational, operational, fraud, strategic, technology, data-security and business-continuity risks. The committee evaluates risk exposure and tolerance and approves appropriate transactional or trading limits. The committee reviews and evaluates the company’s policies and practices with respect to risk assessment and risk management and annually presents to the Audit Committee a report summarizing the committee’s review of the company’s methods for identifying and managing risks. The committee reviews reports of the company’s Risk

Management and Compliance department, which we refer to as the "Risk department", Internal Audit and regulatory agencies relating to risk issues and management's responses to such reports, unless such review is under the jurisdiction of another committee. The committee reviews reports on fiduciary assets of our businesses, provides general oversight of the company's investment of fiduciary assets and adopts the company's fiduciary policy statement. The committee evaluates the scope of work of the Risk department and its planned risk management activities and reviews the appointment, performance and replacement of the company's Chief Risk Officer. The committee is responsible for assessing the company's technology risk management program and receives reports from management regarding the company's technology operations.

BB&T Corporation

Executive and Risk Management Committee. The Executive and Risk Management Committee generally is authorized to have and to exercise all of the powers of the Board between Board meetings, subject to restrictions imposed by the Corporation's bylaws and by statute. The Executive and Risk Management Committee reviews the Corporation's processes for identifying, assessing, monitoring and managing credit risk, liquidity risk, market risk, operational risk, reputational risk and business strategy risk, and periodically reviews and assesses the adequacy of the Corporation's risk management policies and procedures. The Executive and Risk Management Committee also is responsible for reviewing and recommending approval of policies related to management of the BB&T subsidiaries' investment portfolios, interest rate risk, loan portfolios and mortgage banking activities.

Citigroup Inc.

Risk Management and Finance Committee. The risk management and finance committee enhances the board's oversight of risk management. The committee's role is one of oversight, recognizing that management is responsible for executing Citi's risk management policies. The committee's responsibilities include reviewing risk management and compliance policies and programs for, and reports on, Citi and its subsidiaries; approving and adjusting risk limits subject to ratification by the board; and consulting with management on the effectiveness of risk identification, measurement, and monitoring processes, and the adequacy of staffing and action plans, as needed. In addition, the public affairs committee reviews reputational issues and the personnel and compensation committee reviews compensation programs to ensure that they do not, among other things, encourage unnecessary or excessive risk-taking.

Comerica Incorporated

Enterprise Risk Committee. This committee oversees policies, procedures and practices relating to enterprise-wide risk and compliance with bank regulatory obligations. A current copy of the charter of the Enterprise Risk Committee is available to security holders on Comerica's website at www.comerica.com or may be obtained in print by making a written request to the Corporate Secretary. The Enterprise Risk Committee met five times in 2009.

East West Bancorp, Inc.

Risk Oversight Committee. The Board believes an effective risk management system will (1) timely identify the material risks that the Company faces, (2) communicate necessary information with respect to material risks to senior management and, as appropriate, to the Board or relevant Board Committee, (3) implement appropriate and responsive risk management strategies consistent with the Company's risk profile, and (4) integrate risk management into Company decision-making. The Risk Oversight Committee has been appointed by the Board to provide focused oversight of the Company's identified enterprise risk categories on behalf of the Board of Directors. The identified risk categories include: credit, interest rate, liquidity, operational, information technology, human capital, compliance, legal, strategic, reputation, and international. The Risk Oversight Committee currently consists of Peggy Cherng, Rudolph I. Estrada, John Lee, Julia S. Gouw and Keith W. Renken as chairman. The Bank also has a Risk Oversight Committee, which consists of the same directors who comprise the Company's Risk Oversight Committee and which generally meets jointly with the Company's Risk Oversight Committee.

First Commonwealth Financial Corporation

RiskCommittee. To enhance the Board's oversight of risk management, the Board formed a Risk Committee in April 2009 which serves as a dedicated forum to review and discuss risks and risk management policies and practices. Refer to page 15 for a description of the Risk Committee and its members.

- Oversees and reviews information regarding our enterprise risk management framework;
- Reviews and approves our significant risk management policies;
- Reviews and discusses with management the level and trend of risk exposures, including credit, market, liquidity, operational, compliance and legal, reputation and strategic risk;
- Reviews major risks identified by management and strategies employed to mitigate those risks; and
- Assesses risks associated with strategic and operating plans and strategic initiatives.

First Financial Bancorp.

Audit and Risk Management Committee. During 2009, the Audit and Risk Management Committee served in a dual capacity to oversee both the audit and risk functions of the Company and First Financial Bank, N.A. The committee is responsible for overseeing the Company's accounting and financial reporting processes, the external auditors' qualifications and independence, the performance of the Company's internal audit function and the external auditors, and the Company's compliance with applicable legal and regulatory requirements. The committee also assisted the Board in overseeing the Company's enterprise-wide risks, including interest rate, credit, reputation, strategic, technology, operational, legal, regulatory, governance, reputation, and reporting risks. See "Risk Committee" for a discussion of the risk oversight function of the board in 2010. The committee operates pursuant to a written charter that was adopted by the Board of Directors and is comprised of the following directors, each of whom satisfies the definition of independence for audit committee members under the rules of the Nasdaq and the SEC: William J. Kramer (Chair), Donald M. Cisle, Sr., Mark A. Collar, and Richard E. Olszewski. The Board of Directors has determined William J. Kramer is an audit committee financial expert serving on the Audit and Risk Management Committee. The Audit and Risk Management Committee held seven meetings during the fiscal year.

FirstMerit Corporation

Risk Management Committee. The Risk Management Committee oversees and monitors the lending activities of FirstMerit's subsidiaries, in order to help assure such activities are conducted in accordance with FirstMerit's overall credit policies. Towards this end, the Risk Management Committee monitors the level and trend of key risks to FirstMerit and its subsidiaries and oversees management's implementation and enforcement of the Company's risk management framework. The members of the Risk Management Committee are Philip A. Lloyd II (Chair), Karen S. Belden, John C. Blickle, Robert W. Briggs, Richard Colella and Clifford J. Isroff. The Risk Management Committee held eight meetings during 2009. The Risk Management Committee operates under a written charter, a copy of which is available on FirstMerit's website at www.firstmerit.com.

KeyCorp

Risk Management Committee. Mss. Gile and Martin (Chair) and Messrs. Dallas and Sanford are the current members of KeyCorp's Risk Management Committee. The functions of the Risk Management Committee generally include matters such as oversight review of risk management matters relating to credit risk, market risk, liquidity risk, strategic risk, and reputational risk, asset/liability management policies and strategies, compliance with regulatory capital requirements, KeyCorp's capital structure and capital management strategies, including compliance with regulatory capital requirements, KeyCorp's portfolio of "Corporate-Owned Life Insurance," technology-related plans, policies, and major capital expenditures, the capital expenditure process, and together with the Audit Committee oversight review of allowance for loan and lease losses methodology. In addition, the Committee is charged with exercising the authority of the Board of Directors in connection with the authorization, sale and issuance by KeyCorp of debt and certain equity securities and the approval of certain capital expenditures. The Committee is also charged with making recommendations to the Board of Directors with respect to KeyCorp's dividend and share repurchase authorizations. A further discussion of the Committee's functions is set forth on page 24 of this proxy statement under the heading "Board Oversight of Risk." The Risk Management Committee met nine times in 2009.